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Compliments of the author -

AN INQUIRY
INTO THE
TRANSMISSION OF INFECTIOUS DISEASES
THROUGH THE MEDIUM OF RAGS.

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I. INTRODUCTORY.

From the United States Census of 1880 it appears that in that year the consumption of rags by the paper industry, in all the States, amounted to 187,917 tons, and the total value of all the products of the paper manufactories to \$55,109,914. The single State of Massachusetts consumed 62,922 tons, or exactly one-third of this total amount of rags; and with three other of the New England States, namely, Maine, New Hampshire and Connecticut, nearly one-half of all the rags used in the country. The States that came next to Massachusetts in the amount of rags used were: Ohio, with 20,012 tons; New York, with 19,083; Pennsylvania, with 16,678.

About forty per cent. of the rags thus used are imported from foreign countries. From the United States Commerce and Navigation Reports we learn that the importation of cotton and linen rags into the ports of the United States for the last four years has been as follows:—

Year ending June 30, 1882,	76,655 tons.
“ “ “ 1883,	75,517 “
“ “ “ 1884,	83,793 “
“ “ “ 1885,	67,298 “

These importations are from all parts of the world. For instance, in 1884, rags were brought to us from sixty-five different countries. The chief sources of these rags, with the number of tons, respectively, from each country were as follows: England, 28,000 tons; Germany, 25,500; Scotland, 6,500; Italy, 4,500; Belgium, 4,000; the Netherlands,

3,000; Africa, 2,000; France, 1,500; British Provinces, 1,000; British East Indies, 1,000; Japan, 1,000; Turkey, 1,000; Spain, 500.

The importation of rags dates back to at least 1832, a period which covers several epidemics of cholera, as well as of small-pox and other infectious diseases. While the general tendency of the amount imported has been markedly to increase, yet in the year 1885 there was a falling off in the importation from almost all countries except Japan, from which last the amount brought in has greatly increased. One important reason for this diminution will appear below; namely, the imposition for the first time of serious prohibitory regulations, in view of the prevalence of cholera upon the continent of Europe in 1884-85. This diminution was also favored by the fact of some general depression in trade, and also by a general overstocking of the manufactories in anticipation of such restrictions; but it is instructive to note that the diminution in the imports was felt most severely in those ports where disinfection, involving in many cases heavy expense to the consignees, was most stringently exacted. For instance, at the port of Boston, where the imports had averaged 2,000 tons per month for two or three years previous, they fell away to 300 or 350 tons per month.

In the year ending June 30, 1884, ninety-three per cent. of the whole importation was entered at the ports of Boston and New York, and one-third of the remainder at Philadelphia. For the last half of the year 1884 the two ports of New York and Boston received ninety-five per cent of the entire importation.

The large commercial interests involved in the rag trade make it especially desirable that all possible information be gained as to the actual facts regarding the transmission of disease through this channel, in order that any sanitary restrictions which are made shall be strictly in accord with the actual necessities of public protection, and shall interfere as little as may safely be done with the freedom of commerce. In view of the great complaint made among the rag trade throughout the country as to some of the sanitary restrictions of the last two years, and of some apparently unwarranted statements which have been made on both sides of the con-

troversy, it has seemed fitting that the Board of Health of that State which has the largest pecuniary interest in the subject should conduct such an inquiry.

I was requested, during the past summer, by the State Board of Health to undertake an investigation of the general subject, and have since that time made such inquiries as I have had opportunity for. The Secretary of the Board has placed at my disposal such documents as were in his office; and I have availed myself of the assistance which has, in every case, most courteously been given by the paper and rag-trade of the State, as well as of the full stenographic reports of the voluminous testimony and arguments offered before the Committee on Health of the Boston City Government, in fifteen hearings last summer, for the use of which I am indebted to Messrs. Warren & Brandeis, counsel for the petitioners. The abundant literature of the subject I have by no means been able to exhaust; but, so far as recorded instances of infection by rags were concerned, have endeavored to give as much as was necessary to establish the fact, if possible, for each disease in regard to which the claim of this origin has been made.

A *résumé* has been given of the legislation during the last two years in this country and in some of the countries of Europe, in view of the cholera epidemic, for purposes of comparison of the sanitary policy of different governments.

The difficulties in the way of collecting original data have been considerable, owing to the length of time that has intervened since any general prevalence of either cholera or small-pox in this State. It is only when an investigation can be made contemporaneously with the occurrence of the diseases that full data can be obtained. The information that I have recorded, however, may be taken as undoubtedly correct, so far as it goes. It was gained either by personal conversation with men conversant with the facts, or by letter from them. In many cases, particularly from the physicians, it is based on more or less complete notes; while in others, and perhaps more generally from the manufacturers, it is largely from memory. In the latter cases the source of the rags which are supposed to have brought contagion is more or less a matter of doubt. Indeed, even at the time of an epidemic

it would often be difficult to ascertain the source of an infection when foreign and domestic rags are being sorted alternately, and both kinds are handled on the same day.

Information as to the transmission of the other acute infectious diseases, including measles and scarlet fever, is lamentably imperfect, owing to the almost constant prevalence of such diseases in manufacturing towns, so that opportunities for infection are always present. It is also doubtless true that a majority of rag operatives have already had these diseases in their youth, and thus acquired immunity against any infection which the rags might carry. Charts will be found showing the relative fatality from such diseases in the paper-manufacturing towns, in other manufacturing towns which use no rags, and in the State at large.

The results have also been given of a partial investigation into the custom of hospitals as to the disposition of rags which have been in contact with patients suffering from infectious diseases.

II. COMMERCIAL AND INDUSTRIAL.

(a.) *The domestic rag trade* is carried on somewhat as follows: Collectors go about from house to house gathering the various refuse of domestic economy, which includes "paper stock," or old cotton and linen rags. These may come, washed and clean, from the traditional "rag-bag" of thrifty housewives, or may, for aught the purchaser knows, have come direct from the persons of those sick with infectious diseases, or even from the bodies of the dead.

It is here that we are exposed to a peril partially averted by the English law, which (Public Health Act of 1875, sect. 125) imposes a penalty on any person who "gives, lends, sells, transmits or exposes without due disinfection any bedding, clothing, rags or other things which have been exposed to infection from dangerous infectious disorders." The Low Countries also have a similar law, that forbids any one "to convey or to cause to convey, to give as a gift or for use, to cause to give, to sell or cause to sell objects that have been in contact with, or used by persons sick or diseased from Asiatic cholera, typhus, small-pox, scarlet fever, measles, diphtheria and dysentery, punishing transgressors with a fine of

five to twenty-five florins and imprisonment from one to three days."

Besides the rags gathered directly from householders, other rags may be found in the street by the quick eye of the junk collector and picked out of the gutter. The latter rag, though filthier in appearance and of smaller commercial value than the house rags, may yet have been disinfected from any original contagion by exposure to the sun, the rain and the wind of the street, while the cleanest-looking white muslin may come direct from the scarlet fever or diphtheria patient.

Let us now look into the warehouse of the paper-stock dealer in one of our cities. Hither are brought the collections of the peripatetic gatherers, the "junk men." These local collections, with what is purchased, shipped in bags from small dealers in the city and in towns which are the centres of a country trade, are all opened together and sorted by women in the lofts of the warehouse into about three grades of paper stock, the "number one whites," "number twos" (dirty whites and blues) and "colors." Sometimes four grades are made. All trace as to the definite origin of a given rag is here lost. After being sorted, the respective grades are then baled up by means of a press, operated by hand or by steam power, according to the size of the establishment. The bales, containing 600 to 800 pounds of rags, are much larger than equally heavy bales of foreign rags, which latter are baled by hydraulic pressure. They are bound up usually with hoop iron, and are ready to be shipped to the paper mill of the purchaser. One large establishment in Boston, which may be taken as a type of its class, employs six men and twelve women as sorters, and handles fifteen to eighteen tons of rags a day, sorting and baling them. Besides this, it buys from dealers in the larger New England cities and in the West, sometimes as far as San Francisco. Most of these latter rags are sorted and baled in the city where they are purchased, and the Boston house accepts the grading and sells the rags direct to the paper mill without opening them in its own warehouse, and in some instances without bringing them into it at all. In this way they do a business amounting to seventy or

eighty tons a day. The portion of their stock which they sort and bale themselves, and which comes in great part from a radius of a few miles about Boston, usually remains in the warehouse but a very short time, often less than a day; so that it is possible for a given rag to pass from the householder through the hands of gatherer and dealer to the paper mill in a week's time, though usually, no doubt, the period is somewhat longer. The period of retention of the rags at the mill prior to their use is also usually shorter with domestic than with foreign stock, because the former is likely to be bought in smaller quantities and hence used quicker. The bearing of these facts is obvious in relation to the possible transmission of diseases having a comparatively short-lived contagion. I may remark in passing, that the sorters whom I talked with in this particular establishment were, for the most part, healthy-looking women. Two of them had worked respectively twelve and fourteen years at the business with no interruptions, except such as were caused by rather prolific child-bearing, and had never known, either in their own experience or that of their neighbors, many of whom were in the same occupation, any ill effects from rag-working.

(b.) The history of the collection and assortment of *foreign rags* is quite different from that of domestic. Foreign rags pass through many more hands, smaller dealers constantly disposing of them to larger, till they reach the warehouses of the comparatively few packers whose extent of business is sufficient to enable them to export. A careful assortment is then made, the number of grades varying according to the packer. For instance, three large packers at Ghent make respectively twenty-eight, twenty-nine and thirty-two grades of old rags. Importers and buyers in this country know just what to expect in ordering any of these marks. Indeed, it is the requirement of the purchaser for a definite standard whereby he can supply himself with exactly what is required for the particular manufacture that he has in hand, which has led to this careful system of grading. Amsterdam packers make nine to eleven grades. English rags are represented in all by some twelve grades; Scotch, by nine or ten. Königsberg packers

make sixteen grades; Berlin, twenty-four. On the other hand, Mediterranean ports make a smaller number of grades, because of the limitation in the character of the rags there collected. Alexandrian rags are classed only as whites, blues and colors. Smyrna makes four grades; Beirut, four; Turkey, five, but Leghorn has nine or ten; Calcutta has six. Japan has not been a source of rags for our importers more than twelve or thirteen years. At first there was not much grading of these rags, but now about four grades are made by some packers.

The general precision observed in the grading of foreign rags prior to their export means, as a rule, *time*. American buyers in ordering, say a hundred tons, often have to allow for certain grades a month or more for that amount to be made up out of the assortment carried on in the packing-house. Less than ten tons of rags is not considered worth a shipment, and it is common for a large order to be shipped as sorted, covering a period of two or three months.

Besides the delay involved in the passage of foreign rags through many hands and their closeness of classification, the distance involves time in the transportation. North German, Dutch and Belgian rags are usually trans-shipped at London or Hull, on *through bills of lading*, dating from the point of original shipment. Thus, even when carried by steamships, the time of transit from those ports is likely to be nearly a month. Mediterranean rags are often brought by sailing vessels; Alexandrian rags, for instance, generally coming by sailing craft of a very poor character, so that they may occupy three or four months in the passage. Even if brought by steam, Mediterranean rags usually go *via* England, so that the time required is more than a month. Calcutta and Japanese rags also usually come by sailing vessels; the latter often occupy five or six months.

In the summer of 1884 Consul-General Merritt reported to the State Department from London that continental rags — in some cases from cholera-infected localities, as, for instance, from Dunkirk, France — were brought to England and thence reshipped to the United States, and that Hull, where there was no United States health inspector, had been made the point, rather than London, for transshipping these continental rags.

Furthermore, Consul Lathrop at Bristol, England, reported that the Local Government Board order requiring the disinfection of French rags, *unless intended for immediate transportation*, was likely to lead to trans-shipments of such cargoes for the United States.

These communications indicate, in the opinion of their writers, a possibility of losing sight of the true and infectious origin of rags brought into our country from an apparently innocent port. On the other hand, it is claimed by importers that an expert can easily recognize within pretty narrow limits the true *nativity*, so to speak, of a rag; and that, hence, if such persons were employed on this side as inspectors, any attempt at fraud in concealing the real origin of a bale of rags would be easily detected. As has been said above, there is a perfectly legitimate trans-shipment of rags—for instance, at Hull—from the coasting German steamers to one of the ocean lines. The invoice in such cases makes the origin plain, so that no one is deceived into thinking the rags to be English. In cholera times, when the sanitary restrictions of Great Britain prevent the landing of rags at her ports, and leave transshipments to other countries as the easiest resource for the owners, such inspection as has been referred to would be proper, and would seemingly be easily effective.

Finally, the custom in purchasing foreign rags, of operating in much larger quantities than in buying domestics, is likely to lead to an accumulation of bales, so that, on the average, foreign rags remain longer at the mills before being used than is the case with domestic ones. Some of the larger mills visited by the writer were using foreign rags that had been in stock two or three years; while to have a year's stock on hand is not an uncommon occurrence.

The United States Customs Department classifies imported rags into three divisions: (1), Rags, cotton and linen; (2), paper stock, including old papers, jute, manilla, esparto grass, and all substances other than cotton and linen rags used in the manufacture of paper; (3), woollen rags. The last of these classes only is dutiable. The first class includes both old rags and clippings or new rags. A very large proportion, probably 90 to 95 per cent. of them, are old rags; and

it is with these, together with domestic rags of similar character, that the present investigation is exclusively occupied.

(c.) *The Treatment of Rags at the Paper Mill.*—Of late years other materials have, to a certain extent, displaced rags in the manufacture of paper. For newspaper stock, wrapping papers, cardboard and the poorer grades of paper generally, the material used is either wholly or in great part wood pulp, jute, esparto grass, manilla hemp and old papers. Under trade competition and quarantine interference with the importation of rags, even the better grades of paper, both writing and book stock, often contains some admixture, such as wood pulp, clay and gypsum, to increase the weight and save a certain amount of rags.

On being brought out from the store-room the bales are broken up and the rags are first treated by being placed in the duster. This is either an enclosed box in which revolves a cylinder armed with heavy iron spikes, which tear through the masses of compressed rags, pulling them asunder and setting free a large amount of loose dirt; or, as in the case of the “Star duster,” a star-shaped, revolving wire cage, into whose points the mass of rags fall consecutively with each revolution. This dust in great part settles at the bottom of the machine, but a considerable portion of it is diffused in the air of the room. In some cases a hood at the top of the machine is connected with a revolving drum or fan which draws off much of the lighter dust to some receptacle at a distance. The presence of such a ventilating shaft does something for the preservation of the cleanliness of the atmosphere in this room, which otherwise is apt to be pretty irritating to the lungs from the dust which escapes from the interior of the machine.

The rags are taken from the dusting-room to the rag-room, where they are distributed among the rag sorters, who are, for the most part, women. Each has her table or space at a long counter, with a knife-blade in shape like a scythe, eighteen or twenty inches in length, fixed in an upright position. Against this knife seams are opened, and buttons or other useless appendages removed from the rags. So-called “lumps”—that is, matted rags containing poultices, dirt or excrementitious matter—are occasionally found here, not

having been broken up by the duster. These are thrown aside, to be again put through the duster, or else discarded altogether and sold to some mill using an inferior stock. In most mills women are allowed thus to waive the handling of any material which they do not care to pull apart. A process of sorting is carried on at these tables; any rags not adapted for the paper to be made being thrown out for some other use. Various kinds of rags are under assortment in a large room at the same time, being supplied according to the requirements of the particular manufacture. For instance, some women will be sorting German or Italian linen rags, which are admixed in a certain proportion for the higher grade of paper; others, Egyptian or Smyrna, or any other kind of cotton rags; and still others, perhaps, domestic stock, which is to be worked in with the rest. Hence the difficulty, if any case of infectious disease appears, in determining exactly what kind of rags a given woman has worked upon for the period which represents the incubation of the disease. The foreman of the rag-room can tell from his memoranda how many bales of each kind were sorted on each day, but often cannot tell, except by chance, from memory, which rags any particular woman had.

The atmosphere in the rag-room is often dusty, varying, of course, according to the original filth of the rags and the thoroughness with which the dusters have done their work, but still more according as there is or is not any system of ventilation in use. In some of the rag-rooms I visited, even in summer when windows could be open, the atmosphere was quite irritating, though never so bad as in the dusting-room. In other cases much was accomplished in purifying the atmosphere by ventilating shafts connected with fans, which swept out much free dust. In one instance, in particular, an inverted cone was placed above every table, and each of these cones was in communication with an exhaust flue. In this room the exhaust was so strong that it required considerable force to open the door against it. As might be supposed, the air here was very free from dust.

From the piles into which the rags are assorted, they are conveyed to a table having a woven-wire top; on this they are rubbed to detect any stray buttons which may have

escaped observation, while, also, any other undesirable substance is removed. This stage, which amounts merely to a revision of the former assortment, is sometimes omitted. A second visit to the duster is sometimes required if the rags are very dirty. The rags are now conveyed to cutting machines, through which they are passed and chopped into bits of an inch or two in length. They are now ready to be boiled, for which purpose they are introduced into large revolving boilers, mixed with a certain quantity of slacked lime, and steam is introduced under a pressure of sixty pounds, or thereabouts. Here they are boiled for ten hours or more, according to their dirtiness. This process, with the subsequent ones, of treatment from five to eight hours in washing engines, bleaching with chloride of lime, reduction to pulp, renewed washing, tinting and running into paper, does not concern the present inquiry, as all possible chance of infection ceases with the prolonged boiling.

As will be seen, there is comparatively little passing of the rags from hand to hand. The man at the duster is the first to touch the rags, and he may well avoid handling a great part of them, as many are inside the clumps which, matted together by hydraulic pressure in the baling, he throws into the duster. A given rag, a conceivable bearer of contagion, goes in the heap of others to the particular woman whose duty it is to cut off its seams or buttons and to assort it, and she presumably would bear the brunt of its danger. It may be handled again if it goes to a wire table to be rubbed and overlooked; but here there is less chance of its being individually touched. After this, it is very likely not to be directly touched by any one, even by the man who throws it into the cutter or shovels it into the boiler. Hence it is possible, waiving for a moment the question of individual protection by vaccination, that only one or two persons in the mill will be exposed to the contagion from touching a small-pox rag which lies in a bale of innocent cloths. Of course, the greater the number of infected pieces, the wider the probability of infection. But the fact of only a single case occurring in a rag-room does not of itself negative the supposition that the infection came from a rag. Especially is this true in view of the

fact that the one or two others actually exposed may have been protected by vaccination. In addition to the danger from manual contact, there is, of course, that which is shared by a much larger number, — of inhaling the virus suspended in the form of dust. This, in the case of small-pox, is probably a frequent means of contagion.

III. HISTORY OF SANITARY REGULATIONS.

a. In the United States.

By Act of Congress of April 29, 1878, passed primarily in view of the Russian plague then existing, it was provided that when infectious disease was prevalent in any foreign port, the consular or other representative of the United States at or nearest such foreign port should notify the surgeon-general of the Marine Hospital service, and also the health officer of the port of destination in the United States, of the shipment of passengers or *goods* from the infected district. The surgeon-general of the Marine Hospital service, under direction of the Treasury Department, was empowered to enforce a national quarantine against such articles, acting, when practicable, through existing local and municipal health authorities, and in no case interfering with local quarantine regulations. These powers bestowed on the Marine Hospital service authorized isolation of infectious freight, disinfection, ventilation, and even, if necessary, burning thereof. In accordance with this act the surgeon-general of the Marine Hospital service issued an order on March 3, 1879, prohibiting the importation of rags, together with other merchandise, such as furs, feathers, skins, hair, boxed or baled clothing, bedding, etc., from ports of the Black Sea and Sea of Azov. The order was issued on account of the Russian plague, and was rescinded on May 31 of the same year, the plague having ceased.

By Act of Congress of June 2, 1879, the powers conferred by the act last mentioned were in substance removed from the Marine Hospital service and bestowed on the National Board of Health, for a period of four years. At the end of that time there was some question as to whether the expiration of the Act of 1879 revived the Act of 1878, which it had

repealed; and after a little hesitation the Marine Hospital service again issued the regulations in question, which the Treasury Department undertook to enforce through the collectors of customs.

In the spring of 1884 the health authorities of New York, New Haven and Boston agreed upon a method of disinfection for foreign rags, and the State Department attempted to arrange for the certification of the fact of disinfection through the appointment of inspectors in ports of export. But as Congress failed to provide for a consul-general at Cairo, and as the certificate of the inspector must be authenticated by that of the consul-general, the State Department soon after announced its intention of revoking the appointment of persons designated to act as inspectors. Thus, on July 19, the Treasury Department, by Secretary Folger, forbade, until further orders, the unlading of rags from infected foreign ports, and of rags suspected on good grounds of being infected from any foreign ports.

August 30, 1884, the acting Secretary of the Treasury forbade the unlading of all old rags from foreign ports for a period of three months, beginning from September 1. This order, as will be observed, gave no notice in advance, and under it many rags already afloat were prohibited from being landed.

On October 23, another order was issued by the Secretary of the Treasury (Mr. Gresham), modifying the order of August 30, so as to limit it to infected ports only; and all Mediterranean ports were defined as "infected" within the meaning of the order. It was also provided, however, that no old rags should be landed without a consular certificate that they had not been gathered or baled at, nor shipped from any infected place or region contiguous thereto.

November 15, 1884, Secretary McCulloch issued an order superseding those of August 30 and of October 23 as to shipments made after November 20. It prohibited the landing of old rags in the United States coming directly or indirectly from foreign ports or countries then or thereafter known to be infected with contagious or epidemic diseases, and declared France and Italy, as well as all Mediterranean and French ports, to be infected within the meaning of the

order. Rags shipped from other ports, non-infected, required consular certificate to that fact, as well as to the freedom from infection of the places where they had been gathered and baled. This order, as will be seen, in substance added France to the list of infected places. It added also the important qualification that rags should not be landed in any event without the permit of the local health officers.

In December, 1884, Secretary of the Treasury McCulloch requested the opinion of the members of the conference of State Boards of Health, held at Washington, on the general subject of the admission of rags from foreign countries. A committee, appointed for the purpose, made a report, which was taken as the basis of an order issued by the Treasury Department, Dec. 22, 1884, modifying all previous circulars of the department. As this order has become of some historic importance, its main provisions are quoted : —

No old rags, except those afloat on or before Jan. 1, 1885, on vessels bound directly to the United States, shall be landed in the United States from any vessel, nor come into the United States by land, from any foreign country, except upon disinfection, at the expense of the importers, as provided in this circular, or as may hereafter be provided.

Either of the following processes will be considered a satisfactory method of disinfection of old rags, and will entitle them to entry and to be landed in the United States upon the usual permit of the local health officer ; viz., —

1. Boiling in water for two hours under a pressure of fifty pounds per square inch.

2. Boiling in water for four hours without pressure.

3. Subjection to the action of confined sulphurous-acid gas for six hours, burning one and a half or two pounds roll brimstone in each thousand cubic feet of space, with the rags well scattered upon racks.

4. Disinfection in the bale by means of perforated screws or tubes through which sulphur dioxide, or super-heated steam at a temperature of not less than 330°, shall be forced under a pressure of four atmospheres for a period sufficient to insure thorough disinfection.

Old rags may be landed and stored at such places as may be approved by this department, for the purpose of undergoing any of the processes of disinfection before named ; and, upon the comple-

tion of such process to the satisfaction of an inspector of customs and the local health officer, the rags may be delivered to the importer or consignee.

Old rags may be subjected to disinfection by either of said processes in any other country where this department may appoint an inspector to superintend the same, whose certificate of such disinfection shall be authenticated by a United States consular officer, according to Department Circular No. 61, of April 22, 1884.

Despite the intimation of the State Department under date of July 19, 1884, above referred to, to the effect that foreign inspectors would not be appointed to certify to the fact of disinfection, such inspectors were, from time to time, appointed, even after the circular of June, 1885, to be presently alluded to, in which the government abandoned all jurisdiction in the matter to the local health authorities of the several ports. Thus, on March 8, 1886, inspectors had been appointed or authorized in Ghent, Belgium; in Alexandria and Cairo, Egypt; in Berlin, Königsberg, Stettin and Hamburg, Germany; in Catania and Leghorn, Italy; in Kanaguwa, Osaka and Iliogo, Japan; in Cadiz and Malaga, Spain; in Dunkirk, Rouen, Bordeaux and Marseilles, France; in London and Liverpool, England; and in Rotterdam, Netherlands.

The certificates of these inspectors, authenticated by a consular officer, have been appended to many bales of foreign rags, to the effect that the rags have been disinfected, usually by the third process recognized in the treasury circular of Dec. 22, 1884, viz., the sulphur process. Since the revocation of that circular, these inspectors' certificates have or have not been honored, according to the policy of the various local health boards.

The experience of the Seymour Paper Company of Windsor Locks, Conn., deserves a word in passing. This company, in 1879, in order to avoid freightage on the large amount of dust contained in Egyptian rags, sent over to Alexandria a duster for the treatment of all the rags they purchased. About two years ago they sent over a plant for boiling these rags. It is understood that rags thus boiled and dried before baling have always been admitted to this country on certificates to these facts.

The change of administration which took place in March, 1885, foreshadowed a relegation of this subject from the general government to State and municipal authorities. In anticipation of such action a conference of municipal health officers was held at the Fifth Avenue Hotel, New York, April 23, 1885, at which the cities of New York, Brooklyn, Baltimore and New Haven were represented. The conclusions reached, and which were binding, of course, only on the participants, were that disinfection of all rags should be made either at the place of departure or on their arrival here. The "sulphur process" was ignored, and it was declared that disinfection, if performed abroad, must consist either in boiling the rags for thirty minutes and drying them before baling, or in treating them with superheated steam for not less than eight minutes, so as to raise every part to 212° F., or over. Inspectors to certify, in conjunction with consuls, to these methods of disinfection were asked for, and were appointed. All such inspectors were notified that in case of rags destined for either of the four ports mentioned, the disinfection practised should conform to the above requirements.

On June 10, 1885, Secretary of the Treasury Manning issued the order revoking all previous circulars of the department relating to old rags, and directing that thereafter all old rags should be given pratique by the custom-house officers only on the production of permits from the health officers of the ports of importation authorizing the landing of the rags; and that quarantine officers should detain all vessels carrying old rags, subject to the order of the local health authorities.

As might be expected, great diversities of requirement for the landing of old rags at once arose in the different cities. Those which had participated in the "Fifth Avenue conference" just referred to adopted its conclusions, though the health officer of New York, in deference to the third requirement of the now abrogated treasury circular of Dec. 22, 1884, allowed rags to enter, when duly certified to have undergone sulphurous acid disinfection at the port of export. It was claimed by the importers that from eighty to ninety per cent. of the rags brought to New York were thus admit-

ted, without further disinfection, on inspectors' certificates of having undergone the so-called sulphur process. Indeed, this was the only process which was at all applicable to rags in foreign ports; the two specified by the Fifth Avenue conference being held by the trade to be quite impracticable.

The Boston Health Board, in the circular issued in June, 1885, announcing their position, required *all* foreign rags to be disinfected to their satisfaction here, without reference to the fact of their coming from non-infected ports, or of their having undergone disinfection abroad.

The process favored by them, as well as in New York, when no foreign certificate was produced, was the fourth alternative of the treasury circular of Dec. 22, 1884, namely, injection of superheated steam into the bale through perforated screws. This involved the use of a patented apparatus; and the expense of thus treating rags was five dollars per ton, besides charges for lighterage, wharfage, etc.

The greater difficulty of getting rags into Boston, resulting from this action of the sanitary authority, caused a considerable diversion of the importation from this port to others. Where rags carried a certificate of the "sulphur process," they were often sent to New York. Without this they would, in some cases, be sent to other ports, such as Portland, Me., where they were permitted to land, on a consular certificate that they had not been gathered in or shipped from an infected district. Once entered at any port, rags were freely brought within the limits of the State and used as before at the various mills. Any presumed danger to the public health which the rags carried remained unhindered, and the only effect produced was a considerable havoc to the commerce of this port and the carrying trade of the State.

The paper interest of Massachusetts, feeling aggrieved at the stringent regulations of the Boston health authorities, and being unable to secure any modification of these regulations, appealed to the committee on public health of the city council, which held a series of hearings on the general subject during the last spring and summer, at which a great deal of interesting testimony was presented on both sides of the question.

It may be remarked in passing that just at the time of the beginning of these hearings the Boston Board of Health submitted to six gentlemen, all especially conversant with questions of public health in Massachusetts, a request for their opinion with regard to the disinfection of rags as a precaution against the possibility of the introduction of cholera into this country. These gentlemen submitted the following views:—

1. That the treatment of rags from non-infected ports is not necessary.

2. That from endemically infected ports (1) rags be disinfected to the satisfaction of the Board of Health before embarkation; or (2) disinfected externally in bulk at the port of entry and also at the mills after breaking bales; or (3) disinfected after unbaling at the port of entry, at the discretion of the Board of Health.

3. That from epidemically infected ports the importation of rags be prohibited.

The communication was dated March 10, 1886, and signed by H. P. Walcott, Charles F. Folsom, George B. Shattuck, Alfred F. Holt, William F. Whitney, Samuel W. Abbott. These recommendations were not accepted by the Boston Health Board.

Pending the consideration of the subject by this committee of the city government, acting Secretary of the Treasury Fairchild issued on July 26, 1886, a final circular modifying that of June 10, 1885, thus:—

All old rags imported into the United States in vessels which have passed local quarantine at the port of importation will be admitted to entry in the same manner as other imported commodities; that is to say, without requiring special permits from the health officers as to their landing. The fact that the vessel has passed quarantine will be considered as sufficient evidence that her entire cargo is free from infection.

The report of the committee on health to the Boston City Council, upon the evidence presented to them at this series of hearings, sustained for the most part the position of the

petitioners, and advised that the recommendations of the expert sanitarians, above mentioned, be made the policy of the city in the matter of foreign rags. This report concludes as follows : —

We believe that it will be found in most instances to be the course safest for the city of Boston and for the State, in all cases where imported rags can be suspected of infection, to disinfect them “externally in bulk at the port of entry,” leaving local and State authorities to deal with them when unbaled at the paper mills, — where domestic rags, the only class of rags shown to be in the least dangerous, can alone be dealt with.

The committee are accordingly of the opinion that the existing regulations of the Board of Health regarding the disinfection of foreign rags should be modified, so as to allow the admission of foreign rags into this port, without special treatment, when collected in countries where contagious diseases have not prevailed during the six months prior to their shipment, if accompanied by proper evidence of origin.

That all other rags should be admitted without special treatment, or be disinfected in such manner as the Board of Health shall determine in each instance; that all disinfection should be done under the direct supervision of the Board of Health by their duly authorized agents, employed and paid by the city, and only the actual expense of disinfection should be charged the owners or consignees of the rags.

That, where there is difference of opinion in the Board of Health regarding the necessity of disinfecting any particular cargo of rags, or with reference to any particular process of disinfection, the State Board of Health should be consulted, and the joint action of the two Boards shall finally determine the points at issue.

In accordance with the report of this committee, the Boston Board of Health, by circular dated September 14, modified its previous requirements, in the matter of rags, as follows : —

Ordered, That on and after October 1st, 1886, any vessel arriving at this port, which has on board at the time of her arrival, or has had during her passage to this port, any sickness of a contagious or doubtful character which may be detrimental to the public health, or which has on board any rags, paper stock, or any other cargo or personal baggage which has come from or has been

in any port or place which has been epidemically infected with any contagious or infectious disease within the six months previous to such arrival, shall be anchored at quarantine.

All old rags will be regarded with suspicion and detained by the port physician, unless accompanied by a certificate of the United States consular officer at the port of departure, that such rags were not gathered, or baled at, or shipped from any place which has been infected with any contagious or infectious disease in an epidemic form within six months prior to the shipment of said rags. . . .

Cargoes and personal baggage, which in the opinion of the port physician or the Board of Health may be infected, shall be removed to the storehouse on Gallop's Island and there disinfected, when such disinfection cannot be properly done on board the vessel.

This is, at the time of the present writing (Jan. 1, 1887), the rule under which foreign rags are admitted to the port of Boston.

It is proper to mention, in this connection, that during the time when the question of compulsory disinfection of rags has been most warmly discussed, there have been two meetings of the American Public Health Association, the highest representative body of sanitarians in the country. At the meeting in Washington, Dec. 10, 1885, the matter was broached through resolutions presented by the Board of Health of Philadelphia. A committee of five was appointed on the subject, who reported the following resolutions:—

Whereas, It is an admitted fact that the importation of rags is a prolific source for the spread of infectious disease, and that the seaboard cities which are ports of entry, are the gateways through which this infection enters and is distributed throughout various sections of the country; and,

Whereas, There are grave doubts as to the efficacy of the methods of disinfection used abroad; therefore,

Resolved, That it is the judgment of the American Public Health Association that all health authorities having jurisdiction over matters connected with maritime sanitation owe it as a duty to the general public to adopt such uniform systems of disinfection as will thoroughly destroy all disease-bearing germs before the rags are permitted to be distributed for manufacturing purposes.

They further endorsed the report of the committee on dis-

infectants, which was to the effect that "rags in bale can only be disinfected by injecting superheated steam (fifty pounds pressure) into the interior of the bale."

These resolutions, after an animated debate, were, by a vote of 31 to 20 on a division, referred back for a further investigation and report to the committee, which was increased by two members.

When these resolutions were again presented the following year at Toronto, the executive committee of the association to whom the report was referred recommended that the word "uniform" be struck out, and the following added to the resolution:—

If it proves to be impracticable to disinfect them, it is recommended that a disinfection may be commenced in quarantine sufficient to insure safety in transportation, to be completed in the manufacturing establishment by such methods as the health authorities may prescribe.

The association voted to accept the recommendation of the executive committee, and the resolutions were passed as amended.

b. *Sanitary Restrictions upon Rags in Europe.*

The course pursued by the leading countries of Europe regarding the importation of rags during the recent cholera epidemic is substantially as follows:—

England.—An order of the Local Government Board, July 22, 1884, prohibited absolutely the importation of any old rags from Toulon and Marseilles, at the time infected with cholera. (The same prohibition was made regarding Scotland on July 25.)

July 25, 1884, it was ordered that rags coming from Marseilles and Toulon, and landed in England since June 30, should not be removed from their place of deposit without the order of the medical officer of health of the sanitary authority having jurisdiction in such place; and that the medical officer might order them disinfected or destroyed, according to his judgment.

Aug. 8, 1884, an order was issued, to be in force till September 15, forbidding the landing of rags from any

French port, except on satisfactory proof that the rags came neither directly nor indirectly from a place where cholera had occurred within the same year.

September 5, the same restriction was placed, until October 1, on all rags from Italy, and the prohibition against rags from France was also extended to October 1.

September 30, the same restriction was placed, until November 1, on all rags from Spain.

Further extensions of the prohibitions against Italy and France were made from time to time till March 1, 1885, when all orders were permitted to expire, not to be renewed except in case of reappearance of cholera.

In view of the existence of cholera in Spain in 1885, the Local Government Board renewed its prohibition against the importation of rags from the Peninsula to England between June 23 and November 1. It removed the discretionary power bestowed the year before for the admission of rags duly certified not to have been gathered in any place where cholera had existed during the year, doubtless on account of the complaint that had arisen by reason of the differences of ruling on this point among the sanitarians of different ports. But, as before, no hindrance was given to such rags, provided they were to be immediately exported out of the kingdom. On the expiration of this term the prohibition was extended to Jan. 1, 1886.

In August, 1885, the same restriction was imposed upon rags from France.

In 1886, the prohibition against rags from Spain was extended first to April 1, then till August 1, and in Scotland till August 26. It then was allowed to lapse. But, July 3, cholera having reappeared in Italy, the prohibition was again imposed on Italian rags till November 1, and then extended to April 1, 1887. At the time of the present writing (Jan. 1, 1887) this restriction is in force, as well as one laid in the fall of 1886 against Austria-Hungary, — both to remain in force till April 1, 1887.

It will be noticed that the policy of England was to lay the restriction for a definite time upon definite places, the times and places being determined by the actual existence of cholera; to extend the restriction as the continuance of the

epidemic required, and to allow the prohibition to lapse as soon as the disease ceased to be epidemic.

Belgium. — By proclamation of the king, July 18, 1884, the importation of rags, clothing, bedding, body-linen and old clothes, except baggage, was prohibited from all countries where cholera was epidemic. Under this order the Minister of the Interior and of Public Instruction at once forbade importation of the articles enumerated from France, and required special inspection by customs officers in case of importations from other countries. Sept. 14, 1884, the prohibition was specifically extended to Italy, and on December 6 to Spain. By royal proclamation, Jan. 19, 1885, the prohibition was continued against countries still suspected of cholera, as well as those where the disease existed in 1884, but where it had been stamped out, except that new waste from mills in the latter countries was allowed; also clothing, bedding and body-linen (but not rags) from such countries were admitted on certificate that there had been no case of cholera in their special locality since Jan. 1, 1884. Rags and the other commodities were admitted from countries which had had no cholera in 1884.

A month later, Feb. 20, 1885, the quarantine and prohibition of importation in respect of cholera were withdrawn by the king, but authority was given to the minister to present measures of precaution, if necessity arose. Accordingly the latter official directed that rags from Italy, Spain, France, Egypt, Algeria and the Indies must carry a certificate that they came from a town or district not infected, or else that they had undergone preliminary disinfection. In default of such certificates the rags must be disinfected at a public warehouse, under inspection of the police and customs authorities, and at the expense of the parties interested. Rags from other countries than those just specified were admitted, on proof of their satisfactory origin.

Netherlands. — The Ministers of the Interior and of Finance, under authority of a royal order of Aug. 31, 1884, prohibited the importation, after Sept. 12, 1884, of rags, wearing apparel, bed-clothes and linens that had been in use, from France, Italy, Spain, Algiers and Tunis. The restriction was continued in force till Feb. 19, 1885, and

then rescinded, cholera having ceased as an epidemic in these countries. The prohibition was again imposed in August, 1885, for a limited time, against unwashed bedding, linen and old clothes from Spain, Gibraltar and France.

Germany. — All bed-clothes, linens and wearing apparel that had been in use, and all rags, were, under order of Aug. 2, 1884, forbidden to be brought into any of the departments from France. This prohibition was removed Feb. 1, 1885.

France. — A decree of March 15, 1879, issued under advice of the *Comité Consultatif d'Hygiène Publique*, compelled the disinfection of rags from abroad, especially from the Orient, from Egypt, from Algeria, and limited their importation to the ports of Marseilles, Pauillac, St. Nazaire and Cherbourg, which were at that time the only ones provided with sufficient means for disinfection. Soon after, this list, at the request of the importers, was extended so as to include any French port where suitable disinfecting apparatus could be had. Restrictions were maintained against overland importations from Spain, and disinfection was made obligatory at custom houses on the frontier.

A decree of July 21, 1883, prohibited the importation of rags into France over the Italian frontier. Sept. 24, 1884, it was forbidden, until otherwise ordered, to import into France over the Spanish frontier, drills, rags and articles of bedding.

Italy, according to the report made July 11, 1884, by Charles M. Wood, vice-consul, had made absolute prohibition of the importation of rags, old clothes, bones, hoofs, animal remains and fertilizers into Sicily and Sardinia. Imports of the same articles into the rest of the kingdom were also forbidden from France, Algiers and Tunis.

From the above brief and incomplete statement it appears that of England, Germany, Holland and Belgium, which all escaped cholera during the last epidemic, the first three limited their restrictions to the time and place of cholera epidemics, and the last three classed rags among other merchandise, making no distinction. France and Italy, which were so ravaged by the disease, are countries which depend more upon quarantine than upon sanitation.

c. *Protection against Domestic Infected Rags.*

The protection of rag workers against such diseases as are possible to be conveyed through domestic rags is unfortunately very inadequate. We have no statute analogous to those referred to above in England, Holland and perhaps some other countries, making it a penalty for a person to sell or otherwise dispose of rags which have been in contact with patients suffering from infectious diseases. Small-pox, which is so generally treated in hospitals, is thus comparatively unlikely to be spread by rags, because the treatment of clothing and rags is in great measure in the hands of hospital authorities, who are presumably sufficiently impressed with the necessity of destroying any such chance of contagion. As we shall see below, hospitals and dispensaries are as a rule exceedingly careful as to the disposition of their bedding and old cloths. But in cases of diseases treated generally at home, and which at the same time are known to be transmissible by means of articles that have been in contact with the diseased person, no such security exists. The Boards of Health in our larger cities, it is true, issue circulars which are supposed to be sent to every household from which dangerous infectious disease has been reported. These circulars call attention to the various channels of infection, and *recommend* certain precautions, — disinfection of clothes, burning of rags, etc., — accordingly. But there being no power to enforce such recommendations or to report on their observance, there is no doubt that many infected cloths escape burning, and if not directly sold to the rag-collector, are at least allowed to be thrown into the ash barrel, to be poured forth upon the “dump,” and there gathered by thrifty *chiffoniers*, eventually to find their way to the rag-house and the paper mill.

IV. THE RECORDED EVIDENCE AS TO THE CARRYING OF DISEASE BY RAGS.

a. *Small-pox.*

During the fall of 1884, in view of the Treasury Order of August 30, the “Paper Trade Journal,” a weekly paper published in the interests of the trade, sent out a circular to

some 300 paper manufacturers in this country and Great Britain. The replies, of which 182 were from American and 79 from British manufacturers, making a total of 261 received, are summarized in the "Paper Trade Journal" for Oct. 25, 1884.

1. *Question.* "Has there ever been to your knowledge any authenticated case of cholera communicated to individuals from foreign rags?" *Answer.* No (261).

2. "Do you know of any disease communicated to your employees from foreign rags?" No (254). Yes (7, — small-pox, 5; itch, 2).

3. "Do you know of any disease communicated to your employees from domestic rags?" No (219). Yes (42, — small-pox or varioloid in every instance).

Some twenty years ago an inquiry was made in England, under the auspices of the Lords of the Privy Council, by Dr. John S. Bristowe, into the rag trade as regarded the spread of contagious disease, particularly small-pox.* Dr. Bristowe examined rag collecting and sorting establishments in London, and visited eighty-six paper mills in various parts of England. He was able to gain no evidence of any other disease than small-pox having been conveyed through rags. Of the latter occurrence, however, he gathered reports of some seventeen distinct instances, in which no other source of contagion could be discovered. In some of these cases the alleged period of incubation deviates to a considerable degree from that usually ascribed to this disease, one having been three days, and one four or five weeks; but the majority had an incubation of about fifteen days. In several instances the women said that they were aware at the time of the sorting of these rags of a peculiar odor which they then recognized, or afterwards came to recognize, in their own persons as that of small-pox. The source of the infected rags was in several cases fixed as having been towns in which small-pox was at the time epidemic, and "London seconds" were among the grades specially incriminated. In the cases at Thetford Mills, Norfolk, however, which were among the clearest as to the origin of the disease, and which Dr. Bristowe had an

* Eighth Report of the medical officer of the Privy Council, London, 1866.

opportunity of investigating personally, the rags were foreign.

The conclusion arrived at by Dr. Bristowe was that the evidence seemed to show that "small-pox and other infectious diseases are very rarely introduced into paper mills by rags, but to show at the same time that their introduction is possible, and even occasionally takes place." He further notes "as regards the mills in Lancashire, where especially many Turkey and Egyptian rags are used, diseases peculiar to these countries have never been introduced through their agency."

In April, 1881, an outbreak of small-pox occurred among the rag sorters in a paper mill at St. Mary Cray, England. This is fully described by Dr. H. F. Parsons.* Twenty-five cases occurred between April 9 and April 23, which limitation of period Dr. Parsons considers evidence that all or nearly all the cases proceeded from some common source of infection, and not from one another. The disease was present in the town prior to the development of the first case in this group, but Dr. Parsons thinks that there is no evidence that the occurrence of the cases among the rag workers could have been due to infection from any antecedent case in the town.

Of the cutters affected with the disease, only four had cut any foreign rags within fourteen days before their seizure, and a large quantity of rags gathered in London, where small-pox was then extensively prevalent, had just been bought and put into use much more quickly than usual, on account of the stock on hand having run low. These London rags were, therefore, the suspected source of the outbreak.

Dr. Parsons further cites in his report cases of supposed infection by rags, as recorded in various reports of medical officers of health and other authors. Four additional cases visited by Dr. Parsons personally are described. In three there seems some room for doubt as to whether rags were certainly the source of contagion. In the fourth outbreak, at Maidstone, eight girls, rag cutters, were seized with the disease within three days. A week later three more women, who

* Eleventh Report of the Local Government Board, 1881-82. Supplement containing the report of the medical officer for 1881.

worked in the room to which the rags were carried from the cutting-room, came down with the disease. The rags in use were of best quality, clean and white. Indeed, there is no reason why the best-appearing rags may not be as fatal carriers of infection as any. From these original eleven cases, all occurring within the limits of the incubative period, and hence not taken from one another, there followed twenty-three more cases, evidently due to consecutive infection.

In France the number of persons who make a living out of rags is said to be 225,000, and as is well known their social grade is of the lowest. The consumption of rags for the manufacture of paper in France amounted in 1879 to about 100,000,000 kg. per annum; of this amount about 20 per cent. was foreign (the importation in 1877 was 26,000,000 kg.). The port of Marseilles receives about a third of the whole rag importation into the country, and about half the rags brought thither are from Algiers. Dr. Gibert of Marseilles found that in 1874-75 there were in Marseilles 1,017 cases of small-pox.* The deaths in the different *arrondissements* were proportionate to the number of rag sorters in each, and in one precinct, which contained a large number of rag workers, 64 out of the 157 deaths occurred in buildings used for rag sorting, or in others immediately contiguous or opposite thereto. In one house, which had in its cellar a quantity of very offensive rags, there were found six cases of small-pox, of which four died. It is difficult in considering such statements as these to differentiate between the epidemic infections carried by the rags and the other influences favorable to the spread of small-pox, and to which the rag-picking population is especially exposed.

An epidemic of small-pox started early in 1880 at Abenheim, Rhenish Hesse. Among the first cases were five women who worked at cutting and sorting rags in a paper mill. On investigation it was found that a portion of the rags on which they worked had come from Marseilles, where the disease was at the time very prevalent.†

Dr. Ruysch, medical inspector at Maestricht, reported

* See review of Dr. Gibert's paper in *Revue d' Hygiène*, July, 1879, p. 597.

† *Revue d' Hygiène*, 1880, p. 439.

that in 1879 small-pox appeared (no case previously existing in the town) among women working in a paper mill. One of the women had handled rags from Liege, where the disease was then raging.*

The same writer also presented to the Fifth International Congress of Hygiene at the Hague in 1884 a communication upon the subject, "Rags, a National and International Danger," in which he cites, unfortunately without much detail, a number of other cases of the transmission of small-pox through rags. This communication will be referred to again more particularly under the subject of the other diseases to be considered.

A series of cases of an irregular and anomalous form of disease, differing from the ordinary type of variola, but which included some well-marked cases of that affection, occurred in Watertown, N. Y., in the winter of 1875, and were described by Dr. F. B. A. Lewis.† The first cases were all in women working in the rag-room of a paper mill. Seven of these women were attacked at about the same date, the majority being taken ill on February 15. In the first two cases, there was with the fever an eruption not recognized to be variola. The first recovered, but the second died, and the death certificate was filled out as scarlatina.

The third case, which began, like the first, with a crescentic eruption, developed vesicles, and the woman died on the sixth day. This woman alone gave no certain evidence of having been vaccinated, but all the others had been vaccinated.

Case four, a sister of three, had the same symptoms in milder form and made an early recovery.

Case five had hæmorrhagic variola and died on the seventh day.

Other cases followed within and without the mill. In some the variolous type of eruption was well marked, in others it was absent. Some forty cases occurred, in all, with thirteen or fourteen deaths. The mortality was greatest among the earliest cases, and vaccination is said to have had no protecting influence.

* *Revue d' Hygiène*, 1880, p. 439.

† *Boston Med. and Surg. Journal*, vol. 92, p. 64.

The first case of this epidemic occurred February 15. Ten bales of California rags were received at the mill January 28, and ten more February 5. Those rags were all sorted by twenty-one girls on one side of a large room. Seven of those girls were attacked. The superintendent of the room stated that these rags were moist, had a peculiarly disagreeable odor, and that they included many bandages, poultices, and *some entire articles of underwear* stained as though from the bodies of the sick. The rags appear to have been brought to New York by water. The bales were stored with many others which were forwarded to mills in another county, and it is not known that any ill results followed their use.

As will be observed, just one-third of the girls who handled this particular lot of rags were taken with the disease; but others working on the other side of the room on other material were attacked, as were also two or three working in other parts of the mill who simply came into the sorting-room on an errand.

Just what this disease was does not seem certain. That it originated from the rag-room appears quite clear. The presence of variola in some of the patients gives a presumption that other cases from the same origin were of similar character; though it is, of course, possible that infectious rags may have been gathered into this one lot from several different sources, thereby representing more than one disease. Another point worthy of notice is that the rags evidently included some wearing apparel which was whole and tolerably fresh from the wearer. Indeed, the presence of whole articles of clothing among rags is an indication that the owners had some other reason for wishing to get rid of the clothing than that it was worn out. The rags were also damp, in which respect they differ from the ordinary character of baled rags, though the opposite quality of dryness would probably have conferred no immunity from small-pox upon those who handled them.

In response to an order of the Legislature, the Massachusetts State Board of Health made a report * of the number of cases of small-pox occurring in the various towns of the State during the year 1872, and in the month of January,

* Fourth Annual Report of the Mass. State Board of Health, Jan., 1873.

1873, with the supposed source of the infection. In the following towns, eleven in number, the disease is said to have originated from rags: Adams, Blackstone, Cummington, Dighton, Fitchburg, Holyoke, Huntington, Lee, Montgomery, West Boylston and West Springfield. In those towns, during that epidemic, there were, in all, 172 cases of small-pox, out of 5,606 in the entire State. But it is not recorded how many of these cases were referred directly to rags as their source, and how many proceeded from a secondary infection.

The Third Annual Report of the Massachusetts State Board of Health, Lunacy and Charity, January, 1882, in discussing the small-pox epidemic of 1881, which was largely due to unvaccinated French Canadians, says (p. lx): "The disease [small-pox] now exists in Bernardston, carried from a paper mill in Holyoke; in Deerfield, carried by an operative from Turner's Falls; and in Northampton, from the same source."

The epidemic of 1881-82, however, was much less severe than that of 1873, there being not more than 400 cases, all told, in 1882, and a still less number in 1881. Holyoke had 38 cases in 1882, the same number as Boston, but was especially exposed to the disease, apart from its paper mills, by the large number of unvaccinated French Canadians who annually migrate thither for work in its manufactories of every kind.

In the British Parliament, April 23, 1885,* —

Dr. Farquharson asked the secretary to the Local Government Board if his attention had been directed to a statement in the "Aberdeen Free Press" of April 15, to the effect that two cases of small-pox had recently occurred among workers in the Woodside Rag Works, etc.

The Lord Advocate answered that small-pox had in more than one occasion occurred in the works referred to and others. In some of these cases the infection had been traced to rags imported from abroad as well as to the rags collected in this country. The board's medical officer had made inquiries, but as it appeared very doubtful whether, under the Public Health Act, the board could compel the paper makers to disinfect the bundles of rags before

* British Medical Journal, April 25, 1885.

being used, the board had mainly directed the attention of the local authority to the importance of making provision for the isolation and treatment of the infected persons.

Editorially, the "British Medical Journal," in commenting on this case, says that these works have repeatedly been the scene of similar outbreaks of the same disease. It adds:—

It is impossible, perhaps, absolutely to prevent the occurrence of a case of small-pox from this cause without measures of disinfection, which, if applied to all rags, would be prohibitively expensive.

Although we have no reason for assuming that other diseases are not spread by rags, we have only records of small-pox distributed in this way. Against small-pox we have in vaccination an obvious and efficient protection. Since there is reason to believe that infection is conveyed into the human system in the form of dust, any measures to diminish the dustiness of the air would tend to prevent the spread of infection as well as to benefit the general health of operatives.

At the conference of State Boards of Health, held in Washington, Dec. 10, 1884, to which reference has been made above, which conference was invited by the national government to offer advice as to the treasury circular on rags which was then in preparation, Dr. Hamilton, in charge of the Federal quarantine work, stated, in answer to a question, that small-pox *had* been brought to this country through the importation of old rags.

b. *Asiatic Cholera.*

Asiatic cholera is without doubt the one disease above all others in view of which the importation of foreign rags has been looked upon with fear. Nor is this dread unnatural. The great epidemics of this disease which have successively spread over the world, starting forth from its birthplace in the delta of the Ganges, have followed in a striking manner the great lines of travel. The shipments of rags from Calcutta itself, as well as from Japan and from the Mediterranean ports, where the filth and overcrowding of the populace open a wide and inviting door to the disease, have caused great anxiety alike to sanitarians and to the public mind in

countries lying within the possible route of the dreaded invader. The first epidemic of the century did not reach this country at all. The second, starting from India in 1827, reached its height in the United States in the summer of 1832. The third epidemic, the most disastrous of the century, raged throughout the country chiefly in the year 1849. Registration reports which might show its relative severity in the various towns in our State are unfortunately not existent; and the paper industry was then a small one compared with what it is now. A severe epidemic prevailed in what is now the great paper town of Holyoke, but which at that time had neither paper mills nor any other evidence of its present prosperity. The persons chiefly affected were Irish laborers engaged in the construction of the dam, and living in considerable poverty and squalor at the part of the town still known as "the Patch."

The epidemics of 1854 and 1866 were the only others which invaded this State, and they were much less severe than that of 1849. In 1854 there were 765 deaths, of which Boston, Fall River and Charlestown furnished a very large contingent. None of the towns seriously infected were the seat of paper manufacture. In 1866 some 150 cases occurred throughout the State, but having no geographical relation with the paper industry.* The great epidemic of 1873, which was so fatal in Louisiana, the Mississippi Valley and some of the Western States, did not reach Massachusetts at all. So that it is now, fortunately, twenty years since we have had an opportunity of studying the method of transportation of the disease within our own borders.

At the Berlin Sanitary Conference of July, 1884, at which Koch announced his discovery of the peculiar micro-organism of cholera, the so-called comma bacillus, he said:—

I do not think that the infectious matter of cholera can be kept in a dry state. Experience is also in favor of the view that the infectious matter cannot be introduced in a dry state, for we know that hitherto cholera has never come hither by means of goods on the way from India; "never as yet have letters or postal packets intro-

* See Report on Epidemic Cholera, by Dr. S. W. Abbott, Health Officer of Massachusetts, 1885.

duced cholera, even when not, as is now frequently done, pierced through and fumigated. If the origin of the separate epidemics be carefully looked into, it will be found that cholera has never reached us except through human beings themselves.

In Koch's presentation of his views on this occasion he lays special stress on conditions of moisture as favoring the development of the cholera bacillus. Not only does drinking-water furnish a favorable nidus, but so in a marked degree does moist linen. He says: —

The peculiar conditions of vegetation of comma bacilli can be best observed by bringing substances which are rich in comma bacilli, but which also contain other bacteria, — *e. g.*, the contents of a cholera intestine or cholera dejecta, — in contact with moist earth, or by spreading them out on linen and keeping them in a damp condition. Comma bacilli then increase in a very short time; for example, in an extraordinary manner in twenty-four hours.

One of the preparations of comma bacillus exhibited was such a natural pure culture coming from the damp linen of a cholera patient polluted with his dejecta.

Koch's investigations showed that though the growth of the bacilli was very rapid under such favoring circumstances of heat and moisture, yet that deprived of these it was short-lived; and the cardinal point of his discovery was that these bacilli were most speedily and certainly killed by being simply *dried*.

Following the reading of Dr. Koch's paper a somewhat noteworthy discussion ensued. (See *Berliner Klinische Wochenschrift*, August 11, and *British Medical Journal*, September 27.) Among the participants were most of the leading sanitarians of Germany. Many cases were cited in the discussion as to the modes of transference of this disease.

Professor Hirsch said that in course of his investigations at Posen in 1873, under orders from the Imperial chancery, of the question whether and how far cholera could be introduced by personal effects, and how long defiled linen remained infectious, he had found that in several cases where objects had been brought from infected localities to distant neighborhoods previously free from the disease, the personal

effects, after remaining unused for some time, had been unpacked and cleaned if soiled. It was always the persons who had directly to do with those infected things who were the first attacked.

Referring to a case cited by Professor Leyden, Professor Hirsch gave the particulars of it substantially as follows: In the cholera epidemic of 1873 nine cases of the disease occurred in the town of Mühlhausen in Thuringia; all but one of the cases were in one house. The outbreak originated in a woman who had recently arrived in Mühlhausen from St. Louis, United States, *via* New York, Hamburg and Bremen. Her effects reached her early in August. Among them were soiled linen and confectionery. The latter was eaten by her and her sister, and the clothing was sent to be washed. The woman herself was taken with cholera August 25. The individuals occupying the basement of the house used one water-closet in common, and the disease was for the most part confined to them. No case of cholera existed in the town at the time of the seizure of this woman, and the quarter of St. Louis from which she had come and where the clothes had been packed was at the time she left much infected with the disease.

Neither Drs. Hirsch nor Koch admitted the reliability of the case in Mühlhausen, the latter pointing out that cholera had already existed in the place a short time previously. As to the maximum time that clothing infected with cholera had retained its power of conveying the disease, Hirsch thought it was five or six days, but Koch believed it might be four to six weeks.

Dr. Skrzeczka thought that according to Koch's views the bacillus might retain its vitality for a considerable time in wearing apparel, as it was not certain that the drying requisite to its destruction would result merely from the lapse of time. Professor Virchow said that the term "rags" was not a technical one, like "dirt." Old clothes could become rags; and if the old trousers or other clothing of a man who had died of cholera were thrown among rags, it was the same as if his linen were there. The distinction between wearing apparel and rags is not always sharply defined.

Koch replied :—

The possibility of infection through rags was discussed at Vienna and Constantinople, and nobody was able to cite an example of cholera having arisen through rags in paper mills or elsewhere. The rags should, he thought, be thoroughly dried before being packed. But it seemed to be of little use to prevent the importation of rags if human intercourse was to be allowed. The danger of the introduction of cholera through apparently healthy individuals — a danger which cannot be guarded against — is far greater than that of transmitting the disease by rags.

When Virchow formulated this view into the statement, “If the free passage of men be allowed, letters ought also to be permitted to pass,” it was accepted by the conference, no one dissenting.

It is perhaps true that Koch's views as to the sufficiency of *drying* to destroy any chance of the transmission of cholera through contaminated fabrics are colored by his observation of the effect of drying upon the comma bacillus, which he regards as the essential cause of the disease; and it should be admitted that some of the participants in the very conferences at which those views were expressed disagreed with his claim as to the etiological relation of the comma bacillus with cholera, as have also in a degree the English and French cholera commissions. Yet, while it is outside the scope of the present paper to enter upon the merits of this question, we are concerned with Koch's categorical statement on the subject of the non-transference of cholera through merchandise.

Inasmuch as the interference on the part of sanitary authorities with the importation of rags during the last two years has rested largely upon the assumption that cholera was transmissible through that channel, it is important to examine some of the cases of reported cholera infection through textile fabrics, in order to judge if Koch's general negation with regard to rags can stand.

The valuable report on the cholera epidemic of 1873, in the United States, prepared by Ely McClellan, M. D., assistant-surgeon U. S. A., at the request of Congress, for-

mulates a number of propositions as to the etiology of the disease, among which is the following : —

Proposition III. That cholera-dejecta coming in contact with and drying upon any objects, such as articles of clothing, bedding and furniture, will retain indefinitely their power of infection. That in this manner a sure transmissibility of the cholera infection is effected, and that a distinct outbreak of the disease may occur by such means at great distances from the seat of original infection.

The three special cases which are adduced in proof of this proposition are briefly as follows : —

(1.) A family named Tent Have, consisting of ten persons, — five adults and five children, — left Tubbergen, Holland, May 31, 1873. They landed in New York July 5, and the following day started for their destination in Carthage, ten miles from Cincinnati, Ohio. The night of the 9th or 10th they spent in a station-house in Cincinnati, *in which city the cholera was then epidemic*. The next day they went to Carthage, where there was then no case of the disease. July 13, the boxes containing the household goods, which had not been unpacked since their departure from Holland, arrived. The clothing and other effects were taken out and hung up to dry. Two days later, July 15, a child of the family was taken with cholera and died. Within eight days all of the family except two young men were dead. The latter, who were only friends and not kinsmen to the others, had diarrhœa, but survived. A moderate epidemic followed from those cases in the town. In this narrative no evidence is presented that cholera was prevalent on May 31, in Tubbergen, Holland, or at the place of abode of the Tent Have family, whereby the clothing, which was then packed, not to be reopened till they reached their destination in Ohio, could have received the infection which it was alleged to have conveyed. Furthermore, though cholera did not exist in New York at the time of their landing at that port, yet it was epidemic in Cincinnati at the time when this family passed the night there in a station-house five days prior to the first case of cholera among them. Hence this case cannot be considered conclusive of the portability of cholera by clothing.

(2.) The Antonson family, — two adults and four children, — with Christian Oleson, a friend, Swedes, left Vük, Alfoden, 200 miles north of Bergen, and travelled by steamer to the latter city, where they remained three weeks waiting for the departure of a

steamer, and then sailed for New York. Their effects, other than hand luggage, are said to have been packed in Bergen, though one would suppose that to have been more likely to be done at Vük. Cholera was epidemic in Bergen at the time. No disease occurred on shipboard. The vessel reached New York, June 26, 1873. There was no cholera in New York. Hence they journeyed to Willmar, Minnesota, passing through no city where cholera then existed. At Willmar, July 2, just before reaching their destination, the trunks and boxes containing their clothing packed in Bergen were opened and the clothing was distributed. The following day Oleson came down with cholera, and the Antonson family, all except the father, developed the disease in the course of the next few days; four other cases followed. This is presented as an instance of the importation of the disease from Bergen on the Baltic Sea, to a town in Minnesota, the infection having been carried in fabrics of clothing. Many interesting questions which occur are unanswered, as, for instance, whether the clothing had belonged to cholera patients. If it was old clothing belonging to the immigrants for some time previous to their departure, or if it was new clothing obtained in Bergen, in neither case would it have been likely to contain cholera dejections or vomitus, which are generally held to be the *materies peccans* in the conveyance of cholera infection, and which, indeed, is the only means laid down in the proposition under discussion for the transmission of the cholera in fomites.

(3.) Among many bands of Russians, comprising in all some 2,500 individuals, who arrived in Dakota Territory in the summer of 1873 from Odessa and the Crimean district, which were at the time cholera-infected, was a party of several families which reached Yankton, August 25, direct from New York. Each family brought boxes and bales containing their clothing, bedding and cooking utensils. It is to be presumed (but is not definitely stated) that these packages were opened at once on their arrival. Two cases of cholera appeared immediately among children, the disease not having existed at all in Dakota, previously. The Russians lived in a condition and with habits of horrible filth in an unoccupied school-house allowed them, and the disease spread rapidly, chiefly among the immigrants, but to some extent among the townspeople. Here again the fact is not in evidence that the clothing contained any dried dejecta or ejecta, though the disgusting habits of the people make the assumption an extremely likely one. Though the local physicians of Yankton agree in pronouncing the disease to be cholera, yet we are told that many prominent citizens denied it to be so.

These three cases, cited in support of the thesis that cholera is transmissible by clothing (not rags), are not all conclusive, but have varying degrees of probability. Other reported instances, however, give confirmation to this proposition.

Prof. Alonzo Clark says that cholera was brought to this country in the autumn of 1848, in two ships. On October 31, the ship "Swanton" sailed from Havre for New Orleans with German immigrants, and on November 9 the ship "New York" sailed from the same port for New York with the same sort of passengers. Havre was said at the time to be free from cholera. One account says that the immigrants had left infected places in Germany. The ships both had clean bills of health. On November 25 cholera broke out on the "New York," she being then sixteen days at sea. On the 26th it appeared on the "Swanton," she being twenty-seven days at sea. The two ships were a thousand miles apart. The captain of the "New York" reported that a very cold wind came up on the 24th, which caused the immigrants to unpack and don their thick clothing, which, presumably, had been packed at their homes, and some of which had belonged, it is said, to persons who had died of cholera. The next day was warm, and upon it occurred the first case of cholera. The "Swanton," on the other hand, ran into warm weather, and the passengers overhauled their boxes for thinner clothing. Within twenty-four hours the first case of cholera occurred on board the "Swanton." The "New York" arrived in New York December 1, having lost seven of her passengers. The "Swanton" reached New Orleans December 11, having lost thirteen of hers. From these two foci the epidemic spread, though there is evidence that there had been some cases in New Orleans previously, the disease having been brought on other vessels.

Here, again, it is clothing, not rags, which is inculpated as the source of the infection on shipboard.

Frank H. Mason, United States consul at Marseilles, in one of his reports on the cholera epidemic of 1884, cites two instances of the transmission of the disease in clothing. A man in July, 1884, left one of the most affected quarters of Marseilles for his native village of Vogué, in the department

of Ardèche. He remained there in perfect health until he opened his trunk, which had been packed at Marseilles, and wore a suit of clothing it contained. Immediately he and several persons with whom he was living were attacked, and within twenty days fifty-four out of the 630 inhabitants of the village had died. Mr. Mason further reports that the epidemic of 1884 was kindled at Marseilles by the clothing brought to the city in the trunk of a young student coming from the Lycée at Toulon. It will be noticed that in both these cases it was clothing and not rags that carried the infection.

Consul Fletcher of Genoa also writes, in the same collection of reports on cholera in Europe in 1884, that it is reported that the cause of the outbreak of cholera at Spezia was that the Italian fugitives from the cities of Toulon and Marseilles were quarantined there, and that after the expiration of the quarantine these refugees were allowed to land, taking their mattresses and bedding with them, and that those commodities were then sold by them at auction to the highest bidder.

In the address of Dr. Ruysch, at the Hague conference, already referred to, the statement is made that cholera has been transmitted through rags; in fact, the writer goes to the astonishing length of declaring that "its origin and propagation are *always* (*sic*) traced to the influence of clothing, dresses and the traffic in old rags." Sifted down, the evidence presented by this writer regarding the transmission of cholera amounts to this: Six cases are cited in which it has been conveyed in *clothing*, one of them being the statement of Koch, that cholera had been propagated by "clothing still wet from cholera patients." Another is the following: "In the neighborhood of Nimes we see a man from Gige, who, after he had lost his wife from the disease, starts with her linen and dresses to sell them at the city of Certe, afraid that the authorities might confiscate them; but on his way he falls a victim to his own imprudence, and dies by his infected clothing." Again, "cholera was introduced into Aspet (Upper Goronne) by infected clothes from Marseilles." Professor Droschke is quoted as saying that the "cholera epidemic made its victims among the washer-

women and laundresses of Dornbacher-buanderie at Vienna, of whom seven died from cholera after washing infected clothing from cholera patients." "A rag-picker from Amsterdam, where cholera was raging, introduced it into the city of Tilburg in 1866 in a truck-load of *infected clothes*." "Again, at Heusden, Oudenbosch, Hindelopen, Nieusisburg, Leeuwarden and Bois-le-Duc, cholera was propagated by the handling and washing of *old clothes, clothing and bed-clothing, etc.*"

The cases of cholera ascribed to rags reduce themselves to three, of which no particulars whatever are given. The whole evidence is in these words: "At Druten a rag-picker was the first victim in that commune." "At Mearssen, the first one attacked with cholera was a rag-man." And finally we are asked to remember "the cholera epidemic that was raging in Marseilles in the district densely populated with rag-pickers." In the first two of these instances we should require to know the absence of other equally or more probable source of infection, as well as something of the origin and previous history of the rags incriminated. While the third case, in view of the well-known personal habits of rag-pickers in the cities even of our own country, where some degree of sanitation is compelled, the statement that any epidemic "ragged" in the quarter inhabited by them is little wonder, irrespective of the question of contagion brought by the rags in which they worked.

The only definite case that I have been able to find recorded where *rags*, as distinguished from clothing, have carried the cholera, is the following:—

Dr. Geo. M. Sternberg writes in the "New York Medical Journal," Aug. 29, 1885, quoting from a letter received a few days before from Dr. Sonderegger, president of the Swiss *Aerzte Commission*, and delegate from Switzerland to the International Sanitary Conference at Rome, —

The fact relating to rags was observed and described by Profesor Biermer (living now in Breslau as Professor of Practical Medicine) and by Dr. Zehnder, vice-director of the Board of Health (Sanitätsrath), who were both most active at the time of cholera at Zurich in 1867, July, August, September, October; number of patients, 684; number of deaths, 65.9 per cent.

Kriegstetten is a small village in the canton of Solothurn, at 80 to 100 kilometers distance from Zurich, and not connected with this town either by water (lake, river, marsh) or by trade and industrial commerce. There is a paper mill at Kriegstetten, and a work-woman, who had to tear the rags, was suddenly taken ill with cholera and died the following day. The following days sixteen more work-women (all occupied in tearing the rags) were taken sick; of these, eleven died. A careful examination showed that all of these rags went from Zurich, and from cholera houses; therefore the whole mass of rags was disinfected by boiling. After this no case of cholera occurred. The large establishment of the paper mill, as well as the village, remained free. I mentioned the fact in a little address to the Swiss people, which I have the honor to send you, and nobody doubted the fact or made any opposition. The fact was known everywhere in Switzerland.

The only point about this statement which seems open to criticism is the somewhat sweeping statement that *all* the rags were traced to cholera houses in Zurich. If, however, we accept the report, unique though it be, the fact of a rapid transmission of the cholera in rags carried but fifty or sixty miles, conveys but a small presumption in favor of a transmission of the disease through rags carefully sorted, with the assurance thereby given of much handling, involving time and thorough drying, and to say nothing of the period consumed by their transportation across the ocean.

Commenting on this case at the Berlin Conference, Koch expressed his distrust of it, and said that it was very questionable. "Beyond a doubt," he added, "an immense quantity of rags had been transported from place to place, which had been dirtied with cholera-dejecta, but had not caused cholera."

The following extract from an address before the Social Science Congress held at Aberdeen, October, 1877, by Edwin Chadwick, C. B., the eminent English sanitarian, well states the best opinion upon the question of cholera-transmission by rags:—

The Commissioners state in their last report "that facts regarding the movement of cholera show that, whether or not cordons be drawn round stations, no dependence can be placed on them as a protection against cholera, while the employment of troops may be a direct means of augmenting the mortality." They say that "the

entire chain of facts shows the necessity of coping with the disease in the localities themselves, for upon the continued progress of sanitary improvement, especially in the purity of drinking water and of the atmosphere, cleanliness, surface drainage, etc., in the towns and villages of India, it depends whether the intensity of each succeeding epidemic shall be less or greater than that which has preceded it; so far, at least, as past experience enables us to judge. Of minor subsequent observations, confirmatory of the declaration that in none of the quarantine stations was there an instance of the propagation of the plague [cholera] by goods, it was shown in the Rivers Pollution Inquiry that upwards of 70,000,000 pounds of woollen rags are annually imported largely from districts where plague, fever, small-pox and loathsome diseases prevail, and that these uncleansed rags are there [in Yorkshire] sorted by human fingers, before being placed in machines which tear and separate and cleanse the fibre for manufacture into "shoddy," and that for fifty years the manipulation has not been found injurious to the health of those engaged in it. A similar inquiry made at Paris amongst the paper manufacturers, with a view to ascertain the propagation of small-pox by unclean cotton and flax rags, was attended by similar results. These facts are stated simply as confirmatory of our conclusion, that, be it as it might with any other means of transmitting disease, there was no justification for staying the transit of manufactured goods from any infested place at one of them.

c. *Anthrax.* (?)

M. Gibert of Marseilles, whose statements as to the bringing of small-pox into that town in rags have been referred to above, speaks of a rag picker's disease (*maladie des chiffons*, — Haderkrankheit) which has been noted in lower Austria.* The disease is characterized by weakness, loss of sleep and appetite, vomiting, weight at the epigastrium; on the second or third day cyanosis of the lips, cheeks and nails are observed, with cold sweat and ordema of the lungs, but with no brain symptoms. Death is generally quiet, unless there is pulmonary stasis. There are no abdominal symptoms and no albuminuria. After death various lesions of the lungs are found, of no special character. In one shop near Gloghnitz fourteen deaths occurred in a year. Dr. Ollivier, on visiting some of these rag shops, experienced in his own

* See Annales d' Hygiène publique, 1879, tome II, p. 780.

person many of the above symptoms. The work-women attacked were found to be only those who sorted white rags; though in the sorting-rooms we are told that all suffered from chronic lung diseases. This disease, except in so far as it represented a mechanical irritation of the lungs by flying dust, is considered to have been a species of anthrax, though I do not find in any of the ordinary descriptions of this disease any reference to rags as a means of infection.

Dr. Schulz * reported to the Riga Medical Society an epidemic of similar nature which broke out among the rag sorters in a paper mill at Ligat. Of fifty-six women working in the rag-room, five were taken ill on April 25, 1886. All died within five days. April 28, seven men were attacked; one died the next day, but the other six recovered. The symptoms were an intense rigor at the beginning, very high temperature, malaise, loss of appetite, headache, dyspnoea, agonizing cough with scanty expectoration, feeble pulse. In fatal cases, subnormal temperature, with death in extreme collapse. The autopsies showed striking decomposition of the body, profuse transudation of bloody serum in the pleuræ and pericardium. The lungs showed various lesions and the spleen was much enlarged, its capsule thinned and softened, and its pulp almost fluid, — in general, signs of virulent septic infection. The disease was believed by Dr. Schulz, in accord with the views of Klob and Frisch, to have been due to the anthrax contagium, though Dr. Krannhals considered it to be malignant œdema. The well-known fact that the bacillus anthracis is one of the hardiest of all the micro-organisms lends plausibility to the view that the infection might retain its virulency in rags.

d. *Other Diseases ascribed to Rags.*

Regarding the transmission of the other infectious diseases, little is to be found on record beyond some loose statements like that of M. Ollivier (Rev. d' Hygiène, 1885, p. 396), who, in speaking of the dangers from rag depots in France, says that “diphtheria, small-pox, scarlet fever, etc., have been observed in the vicinity of rag depots.”

* London Medical Record, Dec. 15, 1886.

The outbreak referred to above in the paper mills at Watertown, N. Y., in which the earlier cases were diagnosticated as scarlet fever, was doubtless, in view of the later development of the epidemic, one of small-pox.

Dr. Ruysch of the Hague, in the pamphlet already quoted from, has among his cases two of infection with typhus fever from old rags and clothing; but unfortunately they are reported with something of the same lack of circumstance and detail which we have already had occasion to regret in connection with his reports of cholera infection. "In 1868," he says, "various men, working in a paper mill at Wormerveer, had been handling rags from an infected origin, and were taken with typhus." The other case is by clothing, thus: "Petechial typhus was introduced into Frineck, and from there to several other localities in Silesia, by means of old garments worn by people who had died of typhus." The same writer quotes from Richter, who was one of the first writers to sound an alarm against rags as a source of danger, to the effect that "'the plague' was introduced at Bongazy in Mesopotamia by cases of rags." At the hearings before the Health Committee of the Boston City Government, on the petition of the rag importers, a letter was put in evidence, May 7, 1886, from Dr. J. S. Billings of Washington, in which he says: "I am not aware that there is any evidence in existence to show that scarlet fever, measles, whooping cough, cholera, plague or yellow fever have ever been produced among the employees of a paper mill by rags."

IV. PERSONAL INVESTIGATIONS.

a. *Inquiry through Physicians.*

Among the means taken to obtain information regarding the possible transmission of contagion through rags, was the issue of a circular from the State Health Office to various physicians practising in the paper-making towns, chiefly of the State of Massachusetts.

This circular contained the following questions:—

1. Have any cases of small-pox come to your knowledge which are known to have originated among persons employed in paper

mills or in the collection, sorting, baling or otherwise handling of rags? Please to state the circumstances as fully and definitely as possible, including all facts bearing upon the source of infection. Details of special cases are desirable, either from memory or from data in your possession.

2. If rags were known to be the source, can you state definitely whether they were foreign or domestic rags?

3. Have you any evidence to show whether small-pox, cholera, typhoid fever, scarlet fever, diphtheria or any other infectious diseases are more common relatively among rag workers than among the community at large?

4. Have you any data, relative to either of the epidemics of cholera of 1832, 1849, 1854 or 1866, to show that cholera appeared (if it occurred at all in your city or town) sooner or more generally among rag workers than among the community at large?

5. Have you noticed any marked preponderance of cutaneous, pulmonary or other forms of non-infectious or locally infectious disease among rag workers, rag pickers or other persons employed in the handling of rags?

To these inquiries forty-seven replies were received. Of these, twenty-five were to all the questions negative, and in seven of these cases the writers stated that they had had no experience with operatives in mills using rags.

Of the other twenty-two replies, nineteen contain instances of small-pox having arisen from rags; two writers describe each three distinct outbreaks thus caused; four describe two such epidemics each; five others give replies which indicate that they have known of more than one outbreak of small-pox from rags, and the remainder, nine in number, speak each of a single epidemic originating from rags. Hence we have in all at least thirty-three and probably more distinct epidemics reported by these physicians, in which small-pox was transmitted by this channel. The number of actual cases directly due to rags in these thirty-three epidemics is much in excess of that number, but exactly how many such cases there were cannot be learned. The replies as to the source, foreign or domestic, of the rags incriminated in these various epidemics may be thus classified: Uncertain, 5; probably foreign, 3; foreign, 5; domestic, 8.

Among the cases thus detailed, the following are of interest.

Dr. A. M. Orcutt of Hardwick, Mass., writes :—

In April, 1882, I had fourteen cases of small-pox which I traced directly to the paper mill of the Page Paper Company. One Sunday, some boys who were rag sorters entered the mill, and one of the boys, after opening a bale of rags, made a clown of himself, by dressing himself up in a suit of clothes which he found in the rags, hat and all. All had the disease; the clown was the sickest. The disease spread from these cases; no other evidence could be obtained that the disease was contracted from any other quarter. . . . The rags came from New York; were probably foreign, but am not sure. . . .

Dr. S. W. Fletcher, for many years a practitioner of Pepperell, describes two outbreaks of small-pox in that town, which were entirely independent of paper rags, and then continues :—

March 26 and 27, 1882, five or six cases were seen by physicians in four different families. And it was then first learned that two cases of varioloid had occurred, two or three weeks before; but no physician had been called to them, and the patients did not know the character of the disease. These two, a young man and young woman, worked amongst the rags in the paper mill. About eighteen cases occurred in the course of a few weeks. Whether the rags used at that time were foreign or domestic, I do not know. I do not think that any of the cases, after the first two, came directly from the rags. As to the first and second cases I do not know how they came.

April 19, 1883, a man who had been dusting rags in the paper mill was sick with small-pox, — a well marked case; I think that he had never been vaccinated. He came from Ireland a few months before. From this case came two cases of varioloid.

June 23, 1886, Miss Delia Rafferty was sick with what proved to be small-pox. She came from Ireland nearly a year before, and claimed that she had been vaccinated when a small child. I did not find anything to show that she had been. She had been working in the rag-room for about nine months, and for two months before had worked on Egyptian rags which had been through the disinfecting process. They were using some German and some domestic rags in the mill, but for two months, as I am informed by the agent of the paper company, the woman had not worked on these rags. No other case came from this.

A large share of the above is from memory.

Dr. Giddings of Housatonic writes : —

Some five or six years ago two cases of small-pox occurred in my practice among the sorters or cutters—I am unable to say which—at the paper mill. The girls were sisters, and worked at the same bench. One recovered, she having been successfully vaccinated in infancy; the other died, she having never been successfully vaccinated. I am unable to say whether the rags were foreign or domestic.

Dr. E. T. Bradford of Mechanic Falls, Me., writes : —

There have been three epidemics of small-pox since I have practised here, since 1869. All came from persons employed in rag-rooms in paper mills here. At one time about fifteen persons had the disease; five died. There is no doubt but the disease came from domestic rags, so considered by those who have the best opportunity of knowing.

Dr. Hutchinson of Huntington writes regarding the source of the rags from which small-pox broke out in Huntington and also in the neighboring town of Russell : —

Philadelphia, Pa., rags, as a *menu* of Hospital was found in some rags in the mill at Russell.

Dr. Holcombe of Lee writes : —

During my residence in Lee, many cases of small-pox have occurred. All that I can recall have been caused by the handling of *domestic* rags, and following an epidemic in some part of the country. . . . I have always made inquiry, and have had no trouble in determining, in all cases, whether the rags were foreign or domestic.

Dr. G. C. Ashmun of Cleveland, Ohio, writes : —

During the years 1883-84 three cases of small-pox occurred here among “sorters” of rags or their families, who were exposed to no other source of infection known. In one instance a mother took to her home a small shirt and put it on her child, which developed small-pox in about two weeks. The rags were known as domestic.

He adds : —

The answers to above inquiries are given from memory, but as executive officer of the Board of Health here, it has been my duty

to see every case of small-pox which has occurred during the last six years. And at the same time I have watched carefully for signs indicative of sources of infection in regard to other contagious diseases. As yet I cannot conclude that infection from rags has been common among rag workers, but think it possible, as shown in small-pox cases.

Dr. Andrew F. Reed of Holyoke writes : —

Many cases at different times ; have personally seen five cases from one lot of rags.

Regarding the source, he says : —

Some foreign ; more domestic. The statement made that no cases came from foreign rags is *not true*.

Dr. E. G. Best of Turner's Falls writes : —

Six cases (of small-pox) to my personal knowledge were from foreign rags.

Question 3 of the physicians' circular, regarding the relatively greater frequency of various infectious diseases among paper workers than in the community at large, is by implication answered affirmatively regarding small-pox by those physicians who reported cases of that disease due to rags. A certain number of these physicians explicitly state that small-pox is more frequent among such workmen. Naturally those who have seen no cases of small-pox due to rags answer this question negatively, so far as concerns that disease.

Regarding the greater prevalence of other infectious diseases, four physicians answered affirmatively : One, Dr. E. G. Best of Turner's Falls (Montague), as to the group of diseases in general, viz. : " Though I have no evidence to prove my assertion, I am positive that infected rags carry the above diseases." One, Dr. Wilcox of Ticonderoga, N. Y., affirmatively as to typhoid fever, viz. : " Typhoid fever has been more common relatively among the rag workers of the Ticonderoga Paper Company than in any other class of people." One, Dr. Geo. D. Colony of Fitchburg, affirmatively as to diphtheria, viz. : " It is certain that in the epidemics of diphtheria occurring during the last six years,

cases were more common in this class." One, Dr. J. W. Hastings of Agawam, affirmatively as to scarlet fever.

With these exceptions, the remainder of the replies are to the effect that cholera, typhoid and scarlet fevers, diphtheria and other infectious diseases, are *not* more common relatively among rag workers than in the community at large.

Question 4, as to the earlier or more general occurrence of Asiatic cholera among rag workers, during epidemics of that disease, is answered in the negative by every one of the physicians who replied.

To question 5, the total affirmative replies are eight. Two give general affirmatives; of these, one says that there is a preponderance of both cutaneous and pulmonary diseases, but more particularly of the latter. Four specify a preponderance of pulmonary diseases only, if we include one, Dr. Andrew F. Reed of Holyoke, who says: "Pneumonia is more fatal but not more frequent." Dr. Hastings of Agawam says: "Pulmonary disease is quite common." Dr. Holcombe of Lee says: "I have always observed that pulmonary diseases are more common, especially among women who cut and dust the rags." Dr. C. O. Carpenter of Holyoke says: "Until two or three years past phthisis was very prevalent among young girls in rag-rooms. I have seen very few cases in the last two years; less dust."

Two give doubtfully affirmative answers regarding cutaneous diseases. Dr. C. G. Carleton of Lawrence observes: "A possible preponderance of cutaneous diseases; but I have no recorded data." Dr. W. G. Breck of Springfield says: "In a few cases eczema and ozæna had apparently some connection with the handling of rags."

In addition to these eight affirmative replies should be mentioned that of Dr. E. T. Bradford, who says: "The dust from rags is liable to give women cough; I have not known any serious pulmonary disease directly caused."

b. *Inquiries of Manufacturers.*

These were made in part through circulars and in part through personal visits to paper mills in various parts of the State, and in one instance outside the State.

Of the seventy-four answers received to inquiries, nineteen were to the effect that no rags were used in the establishments. Deducting these cases, there remain fifty-five.

Of these replies we have thirty which report never having had a case of small-pox among operatives during the term of their employment in the factories. These thirty mills employed in all 3,082 persons, of whom 1,136 were brought into direct contact with rags prior to the time when they undergo boiling or chemical treatment; that is, they worked in the breaking of bales, sorting, cutting or otherwise handling of rags during the time that the rags might retain any possible infection. The amount of rags thus handled during the past year in the twenty-five of those mills which reported on that point was about 36,000 tons, and most of the mills had been in business many years; so that the total amount of rags which had been handled in these thirty manufactories, without ever having caused small-pox, must have amounted to several hundred thousand tons.

The foreman of the mill at Modena, Chester Co., Pa., whose report covers a period of five years, during which the mill has been under its present management, in which one case of small-pox occurred, adds, that prior to the purchase of the property by the present owners, it had existed as a paper mill for over seventy-five years, being operated successively by three generations of one family of Friends. Being intimately acquainted with this family, the present superintendent, Mr. Jackson, asked of the living representative, who had himself run the mill for thirty years, regarding the points inquired for in our circular, and learned that no small-pox or other infectious disease had ever during their ownership or to the best of their memory occurred among the employees of the mill. Up to 1872, four-fifths of the rags used, then averaging a ton per day, were collected within thirty miles of the mill by wagons sent around for the purpose; the remaining one-fifth were foreign rags. From 1872 to 1881, four-fifths of a ton each of foreign and domestic rags were used daily. The "country, mixed rags," as collected in the neighborhood of this mill, are much superior in point of cleanliness to domestic rags gathered in the cities and large towns. This informant further states

that in his own experience of forty-four years, as operative and superintendent, always in mills where foreign rags were used exclusively, he has never yet met with any disease of an infectious character among the operatives of a paper mill.

Mr. L. F. Claflin of the Claflin Paper Company of South Toledo, Ohio, writes: "My reply to your inquiries, after being in the business of making paper for forty years, is that I have never known a case of sickness from the handling of domestic rags in sorting."

Twenty-five manufacturers report that cases of small-pox have occurred among operatives during the term of their employment in the factory; nineteen of these informants specify the number of cases that have occurred, aggregating forty-three; four others simply answer the question affirmatively, showing that they have known at least one case; two others say they have known of several cases. This makes a total thus reported (if we assume "several" to mean three or more) of at least fifty-three cases reported by the manufacturers. It is probable that some of these cases are the same that were also reported by the physicians.

Regarding the source of the infection, one "declines to say" what sort of rags were in use when the small-pox broke out; eight are inclined to ascribe it to something other than rags, — that is, three say "not traceable to rags," which may simply mean that they failed to establish any certain connection between the small-pox and any contagion-bearing rags; five say definitely that the disease was not due to rags. But in three of the latter cases this verdict is to be set aside, in one instance because it conflicts with the account given by the local physician as well as by the foreman of the rag-room in personal conversation, and in two other cases because on further inquiry it appears that the only reason for the statement that rags were not the cause was the fallacious reasoning that (*a*) the rags were domestic, and (*b*) the infection could not have come from rags, else everybody in the rag-room would have been affected, instead, as was the fact, of only one or two!

Of the remaining replies as to the origin of the rags, three express doubt; one specifies foreign rags; and the

other twelve, domestic rags. As to the more definite origin of these domestic rags, we learn that in one case they were "No. 2 country rags," collected from the Hudson River towns and traced to small-pox regions. Another reply is: "Domestic white rags shipped from the city." Another: "The cases of small-pox or varioloid originated from rags collected in New York City." Still another: "The small-pox referred to was from domestic *white* rags; we were then using a higher grade of stock than now." Ex-Lieut.-Governor Byron Weston says: "I have been among rags for forty years, and never heard of any disease coming from them except small-pox, and I consider foreign rags safer than domestic."

A fair example of the small-pox experience of a large paper mill in a small village is the following, obtained by personal conversation with the foreman of the rag-room of the Cumberland Mills at Westbrook, near Portland, Me. This was an intelligent man who had lived in the village thirty-one years. The town is a small one, and its only industries are the paper mill referred to and a cotton mill in the village of Saccarappa, one mile distant. The informant, who is intimately familiar with everything relating to the town, says that about 1860 there were several cases of small-pox at Saccarappa in one family, none of whom worked in the cotton mill. The source of the disease was unknown. Since then, the only outbreaks of small-pox have been at the village near the paper mill, and have been as follows: In 1866, small-pox broke out in the person of two sisters, and one other girl not related to them. All three worked in the rag-room. One other girl, a sister of the first two, but not a rag worker, took the disease. Only these four cases occurred; all recovered. The three rag workers had all been vaccinated in infancy. At that time more than half the rags used were domestic, and it is supposed that it was domestic rags which caused the disease.

About 1870, a girl in the rag-room took varioloid, and communicated it to two other members of her family. All had been vaccinated, and all had the disease lightly. No other cases occurred. It was supposed, but not absolutely known, that domestic rags were the source of the infection.

About 1878, two girls of different families, in the rag-room, came down with small-pox nearly simultaneously. One of them had a sister, also in the rag-room, who did not take the disease; but two of her younger brothers did take it, and one died. Total number of cases, four; particulars as to vaccination wanting. At that time few domestic rags were in use, but one of the girls taken thought she had been sorting white rags, and if so the rags were domestic.

In 1882-83, a rag-room girl took small-pox; but she had only been home a week from a three weeks' vacation in some back country town. She went and returned by cars. Hence it was supposed she got the disease outside the town. No other case occurred.

A mill superintendent informed me that many years ago, when he was connected with a paper mill at Gardiner, Me., an outbreak of small-pox occurred in the family of the fireman of the manufactory. The work of this man did not bring him in contact with rags at all, and the source of the attack remained a mystery, until it was discovered that the man had stolen some cloths that were large enough to be considered of use, and taken them home. His wife washed them, and hence came the infection. This case is worth remembering in connection with the one cited above, where the disease was communicated to boys who wore clothes picked out from bales of rags. In each case it seems probable that discarded whole garments had been thrown among the rags.

To the question, "Are other infectious diseases (scarlet fever, typhoid fever, diphtheria) more prevalent among such operatives than among the community at large?" fifty-five replies were received, all in the negative; five even went so far as to say that they thought such diseases were less frequent. Only one gave a reason for his belief, and that was that the lime, chlorine and disinfectants used in the manufacture had the effect of diminishing the chance of infection. It is manifestly impossible that any such effect can be produced by bleaching and cleansing substances upon rags in the dusting, sorting or cutting rooms, with which alone we are concerned.

The incompleteness of the data upon which these replies

as to the relative frequency of the various infectious diseases among rag operatives and the general public are based, is obvious. For a more satisfactory answer to this question we must await the tabulation of relative vital statistics on these diseases, given below.

I ascertained that in the town of Westbrook, Me., a severe outbreak of scarlet fever occurred some three or four years ago, necessitating the closing of all the schools, but that no cases whatever occurred among the large number of persons working in the rag-room of the Cumberland mills in the same village.

The following questions were asked by circular regarding vaccination: "Are precautions taken that operatives are vaccinated as a requisite to employment in factory, and in the case of an incorporated manufacturing company, are the provisions of chapter 80, section 54, of the Public Statutes* complied with?" "Is re-vaccination required, either after stated intervals or on an outbreak of small-pox?"

Of fifty-two replies returned from rag-using mills, twenty-eight were affirmative to the former of these questions; two others required vaccination only when small-pox was epidemic, and one did not require it, but advised it. Seven neglected to respond to the question, and presumably did not require vaccination at all. Of these, five were situated outside this State. Fourteen replied "No" to the question; of these, nine were outside the State.

In the matter of compulsory re-vaccination, fourteen replied negatively and eighteen failed to reply, making probably thirty-two who did not require re-vaccination of employees. Twenty answered affirmatively; of whom five specified that the re-vaccination was required at stated intervals, and six that it was required only when the disease became epidemic. The other nine did not specify on which of the two systems the times for re-vaccination were determined on.

* The chapter referred to is as follows:—

Incorporated manufacturing companies, superintendents of almshouses, State reform schools, industrial schools, lunatic hospitals, and other places where the poor and sick are received, masters of houses of correction, jailers, keepers of prisons, warden of the State prison and superintendents or officers of all other institutions supported or aided by the State, shall, at the expense of their respective establishments or institutions, cause all inmates thereof to be vaccinated immediately upon their entrance thereto, unless they produce sufficient evidence of previous successful vaccination within five years.

It is proper to remark, in passing, that these replies indicate a serious neglect on the part of quite a number of corporations to provide for the protection of their employees, the danger of contracting small-pox from rags having been abundantly demonstrated; also that this neglect appears to be commoner in manufactories outside of Massachusetts, especially in the Western States, than in this State, where we have the safeguard of a statutory provision. There is, however, evident need of supervision that this law be enforced.

The following question was asked: "Is the number of days of sickness, as indicated by the days off, according to the pay-roll, greater for that class of operatives who are employed in dusting, sorting and cutting the rags, than for persons of the same sex who are engaged in the later stages of manufacture?"

To this question the reply was unanimously negative, except in one case, where the answer No was probably intended. Five even went so far as to say that the number of days of absence from work was less among these operatives than among others; one of them giving as a reason that most of the rag sorters were Irish. One reply was to the effect that operatives were "sometimes choked with dust," but suffered in no other way.

Personal inquiry confirmed, so far as it went, the view that the health of the rag workers was as good as that of any other class of employees. In one or two cases the pay-roll of mills was shown me, with the number of days for which each person drew pay. In one instance other parts of the mill were kept running day and night, while the rag-room was open only in the day. Hence while other operatives could work extra time, the rag sorters could not, and therefore made less hours per month. Indeed, as a rule insurance companies forbid the use of artificial light in rag-rooms; so that these operatives cannot in winter work more than nine hours, while the rest of the employees can work full time. The constancy of labor of rag sorters was sufficiently shown by the pay-rolls.

There was a little embarrassment in using the courtesy of mill owners to ask of their employees questions which might

suggest to the latter that they were engaged in an unhealthy occupation. But the opportunity was freely extended to me to ask such questions, and the invariable reply received indicated that the women did not consider their calling an unhealthy one. Many of them had been engaged in it for years, and none reported any sickness as ascribable, in their own minds, to it.

Perhaps an exception should be made to the foregoing statement with regard to the men working in the dusting-room. One foreman stated that the men did not care to stay in this position long. As he expressed it, they "got thin" from swallowing so much dust, and either left or asked to be transferred to other work. This, of course, is due merely to the mechanical irritation of the dust, and has nothing to do with any infectious character of the rags. *Per contra*, I learned of cases in which men performed even this work without experiencing any evil results for very long periods of time. For instance, a man worked thirty-five years at putting rags into the cutter, and lost scarcely a day from illness. He was finally retired on account of old age, and is now a healthy man of seventy-five, having just gone through an attack of pneumonia.

In one of the mills at Holyoke I saw a woman who has worked for twenty-three years at cutting rags, and who was said by Dr. O'Connor to have long had the physical signs of tuberculosis. It has made very slow progress, and she has scarcely ever lost a day from her work.

Inquiry was made as to whether any measures were taken at the factories for disinfection of rags in the bale, or immediately after unbaling and before they were handled. No case was heard of in which anything of this sort was done. Most of the manufacturers who were talked with on the subject expressed the opinion that such disinfection was quite impracticable, though one gentleman saw no reason why, if it were thought necessary, a sulphur disinfection could not be accomplished when the bales were first opened. A chamber, of course, would have to be constructed for the purpose, with shelves for exposing the rags. In like manner, a room in which the rags could be exposed to dry heat at a temperature of 300° F. (150° C.) would doubtless be effective in

destroying any infection before the workmen came in contact with the rags. Probably the expense of the extra handling, of the time consumed and of the means of securing the exposure either to sulphurous acid or to dry heat, would constitute the real objection of manufacturers to either of these methods. Any disinfecting process, however, which involved moistening the rags, as by boiling or by steam, would prove a very serious drawback to the manufacture. The dusting, sorting and cutting can only be done when the rags are thoroughly dry, and hence any moisture applied would have to be wholly eliminated before the process of manufacture could be begun.

The amount of dust suspended in the atmosphere of rag-rooms has an important bearing on the health of the workman; largely, no doubt, from its mechanical effect, but also, perhaps, as carrying into the lungs absorbable noxious matter, as phthisical sputa, and perhaps other disease germs. Inquiry was therefore made as to the provisions for ventilating the dusting, sorting and cutting rooms. Of fifty-three mills from which information on this point was sought, three gave no reply. Fourteen had a more or less complete apparatus, consisting of fans revolving before exhaust shafts, for drawing the dust out of the room. A similar device is in use in most cases in connection with the dusting machine, and sometimes one is placed over the cutting machine. It is in the sorting-room, however, that it is most needed, because here the greatest number of persons are congregated, though of course there is less free dust here than in the dusting-room. In two cases ventilation was effectively accomplished through a cylindrical shaft, six feet or so in diameter, placed in the roof of the rag-room, and forming a natural draught of considerable strength. In addition to the above, nineteen mills assert that they have a "ventilating process," but fail to specify in what it consists; fifteen mills report that they have no ventilating appliance other than open windows. Including with these the three who did not reply, there are probably eighteen out of the fifty-two mills which do nothing towards ventilating their rag-rooms. It may be remarked that the difference in atmosphere in different mills, according as they have or have not some satisfactory method of re-

moving the dust, is very great. In the mill referred to in an earlier part of this article as having so complete a system of ventilation, each of the operatives was furnished, prior to the time of the introduction of the ventilating shafts, with a respirator, consisting of a moistened sponge, for intercepting the flying dust.

c. Inquiries of Hospitals.

The existence in paper stock of bandages, poultice cloths and other fabrics which have evidently been used about the sick, was, perhaps, formerly more frequent than now. During and soon after the late war such cloths were found often among domestic rags, and during the Crimean and other European wars they have been seen in some bales of foreign rags. Rags stained with blood and excrementitious matter, as well as poultice cloths, especially "mustard poultices," are now not rarely met with. Of course, poultice cloths from cases of pelvic inflammation, and from other diseases where the skin remains intact, are not capable of causing any harm to those who may handle them. There is, however, reason to suppose that rags less innocent of contagion and disease find their way into the paper mills. It is evidently almost impossible to trace them to any private house. It is probable that through thoughtlessness on the part of householders foul rags are thrown away, and are carried away with ashes and other refuse. Rag-pickers who go over the ash-heaps are tolerably certain to recover all such bits of cloth and to sell them. With very little expectation of finding any such sanitary sins at the doors of our hospitals, which are so generally under medical supervision, it was yet thought interesting to learn the usage of these institutions regarding the disposal of their rags. Accordingly the following questions were sent to a number of hospitals, dispensaries and other public institutions treating disease : —

1. Are any of the following diseases treated at your institution : Small-pox, measles, scarlet fever, diphtheria or typhoid fever?
2. If either of such diseases are treated, what means are taken to disinfect the bedding and clothing used in these cases before such articles are used for other patients?

3. Are old cloths which have come in contact with patients suffering with contagious diseases sold to rag collectors, and, if so, what means are taken to disinfect such rags?

4. What disposition is made of old bandages from suppurative surgical diseases and erysipelas? Also of poultice cloths?

Replies were received from fifty-nine hospitals; ten of these were small-pox hospitals. Three of the latter are in the habit of fumigating with sulphur all bedding and clothing after use on small-pox cases. One, in addition to this, treats the clothing with carbolic acid; six burn all such articles.

As to the disposition of any old rags that have been in contact with patients thus diseased, one simply says that they would not be sold, six say that such rags are burned, and three that they are either burned or buried.

Thirty-eight other replies were received from hospitals not exclusively devoted to small-pox. Five of these were institutions which treated small-pox in addition to other infectious diseases. The majority treated all except small-pox, though a few were restricted to typhoid fever, and a few others took typhoid and no others, except as measles, scarlet fever and diphtheria broke out among those who were already inmates.

The method of treating bedding and clothing before these were given to other patients was in the main very satisfactory. Twenty-two of the hospitals used fumigation by sulphur; twenty, various disinfectants in solution, as corrosive sublimate, carbolic acid, chloride of zinc, etc.; eleven employed boiling; seven, steam, usually applied to the hair of mattresses, and six destroyed the infected articles. Most of these hospitals employed more than one method of disinfection; as, for instance, fumigation for what was likely to be injured by water, disinfectants for bed and body linen, making over and steaming of mattresses, burning of the latter in case of small-pox, etc. The Long Island College Hospital, for instance, burns straw, as well as all old bandages, poultice cloths and other rags in a furnace constructed for the purpose. Other bedding and clothing are disinfected by chlorine and a steam tank.

Two only gave unsatisfactory replies to question 2; one hospital, treating only typhoid fever, used no precautions as

to clothing and bedding being supplied to subsequent patients, and another disinfected only such clothing as appeared to be soiled by discharges.

To question 3, all but one of the answers were negative, and it appeared that all such rags were burned. In one instance it was reported that although most of the rags were burned, some were disinfected by fumigation with brimstone. These presumably find their way to paper mills.

To question 4, thirty-three of these general hospitals reply that all rags from suppurative surgical diseases and erysipelas, as well as poultice cloths, are burned; though two or three specify that clean white rags are not so destroyed. One hospital mixes befouled rags with chloride of lime and mingles them with the ashes of the ash-barrel, and another simply says that such rags are removed every few days with the ashes. These are evidently neither washed nor disinfected, and there is no doubt that enterprising rag-collectors speedily rescue them from the ash-heap, whence they find their way to paper mills.

Eleven other replies are from hospitals where no contagious diseases are treated, or else from dispensaries which treat patients with infectious diseases only at their homes through visiting physicians. The executive officer of the Demilt Dispensary of New York writes: "Undoubtedly much of the clothing of, and much bedding which has been used by and about, persons sick with contagious diseases is sold, or is thrown into the streets by them or their friends, without disinfection, notwithstanding all effort to prevent such action; since these persons are not under the control of the physician, except possibly during his actual presence."

Another dispensary reports that the cases under care of out-of-door visiting physicians are reported to the Health Board, and the latter are supposed to direct such measures as they may deem necessary. "Usually," says the writer, "I think very little is done excepting in small-pox, typhoid and severe diphtheria." In regard to old cloths from contagious diseases, the same writer says: "I think they are either washed and used again, or sold to rag-collectors without any disinfection."

The old bandages and poultice cloths used at these dispensaries are generally reported as being burned. But in the State workhouse at Bridgewater some of them are cleansed in carbolic solution and used again, and at one dispensary they are simply thrown into the ash-bin.

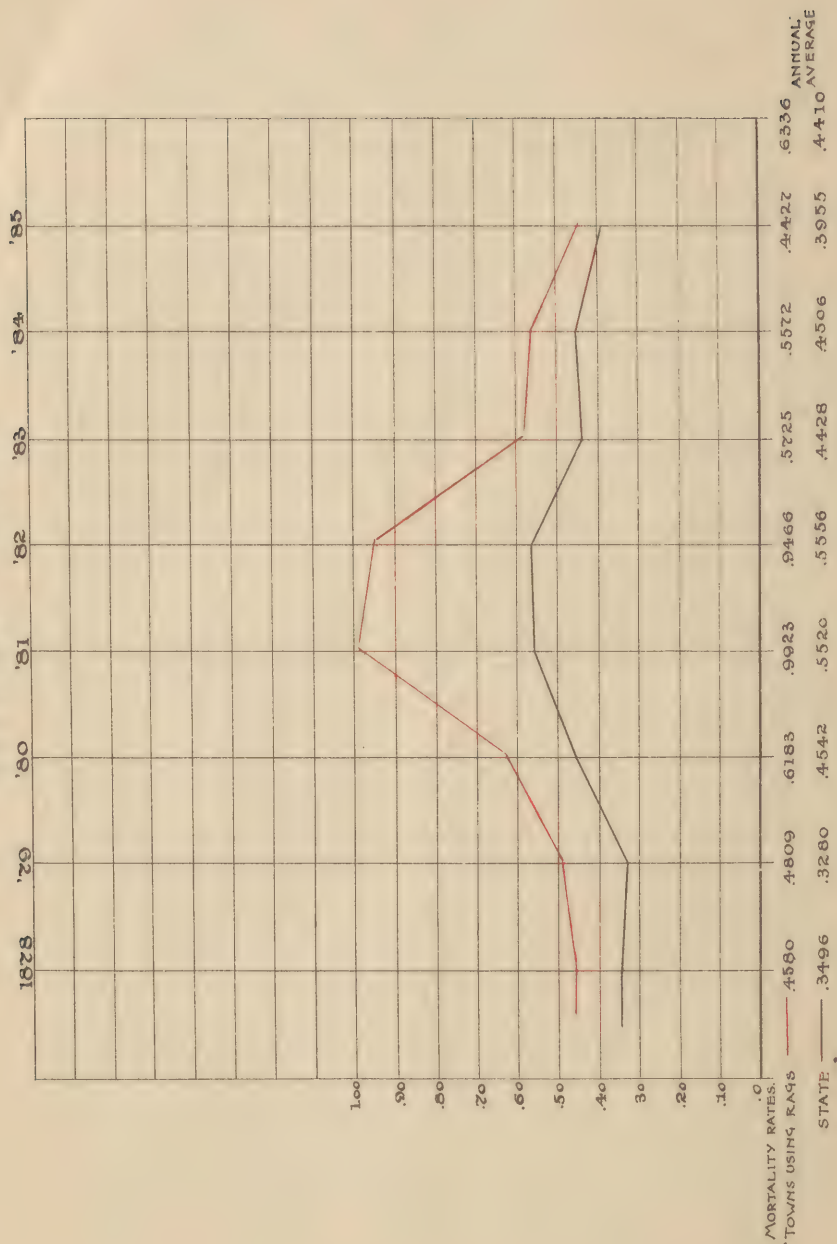
d. *Relative Frequency of Acute Infectious Diseases in Paper Towns and Elsewhere.*

Supposing an aetiological relation to exist between a rag used — as such articles frequently are — in the place of a handkerchief by a scarlatinous patient, and a case of scarlet fever in a paper-mill operative, it is manifest that from whichever end of the chain of cause and effect we attempt to trace the links, it will be difficult to progress far. At the causal end we shall soon find the infected rag inextricably intermixed with others, in no way differing from it in appearance, from adjoining houses, and, by the process of sorting in the paper-stock warehouse, possibly associated with rags of far remote origin.

If, on the other hand, we investigate the sick patient, we find that there are very many other sources from which he may have contracted a disease, which is almost always present somewhere in every community. A chance word with a stranger, a seat in a public conveyance previously occupied by some unknown infected person, the reception or handling of a letter, — these, and many other events which are sufficient to baffle the investigator of cases in ordinary domestic practice, conspire to make an infection through rags wellnigh unprovable. Hence the absence of demonstrated cases of transmission by rags of the common eruptive diseases, which are always epidemic, is much less conclusive of the non-existence of the fact than would be a similar absence of proven instances in a disease whose means of epidemic introduction are few, — as, for example, cholera.

In view of the impossibility of following out individual cases bearing on the question of the transmission of scarlet fever, measles, typhoid fever and diphtheria by rags, it was determined to make a comparison from the mortality tables as shown by the registration reports for the various towns in the State. These reports of separate cities and towns cover

TYPHOID FEVER.



TOWNS USING RAGS. (IN THE STATE, AND IN PAPER-MILL-TOWN/USING-RAGS) DIPHTHERIA & CROUP. SCARLET FEVER.

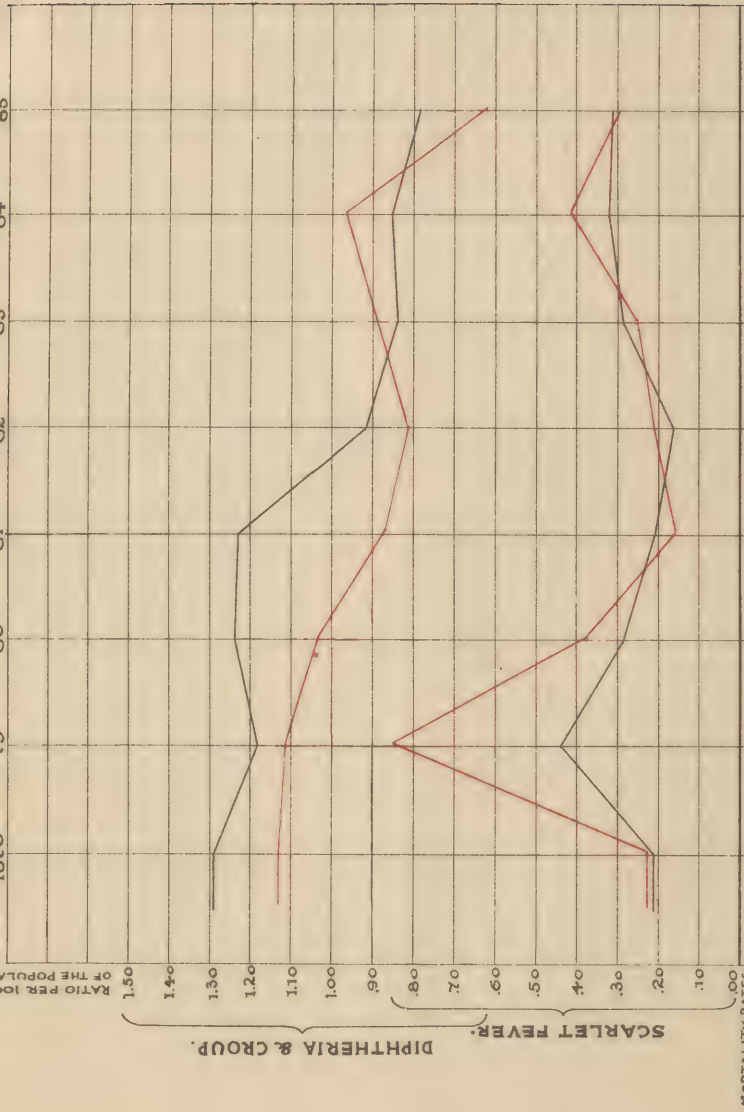
1828 '79 '80 '81 '82 '83 '84 '85

RATIO PER 1000 OF THE POPULATION.

DIPHTHERIA & CROUP.

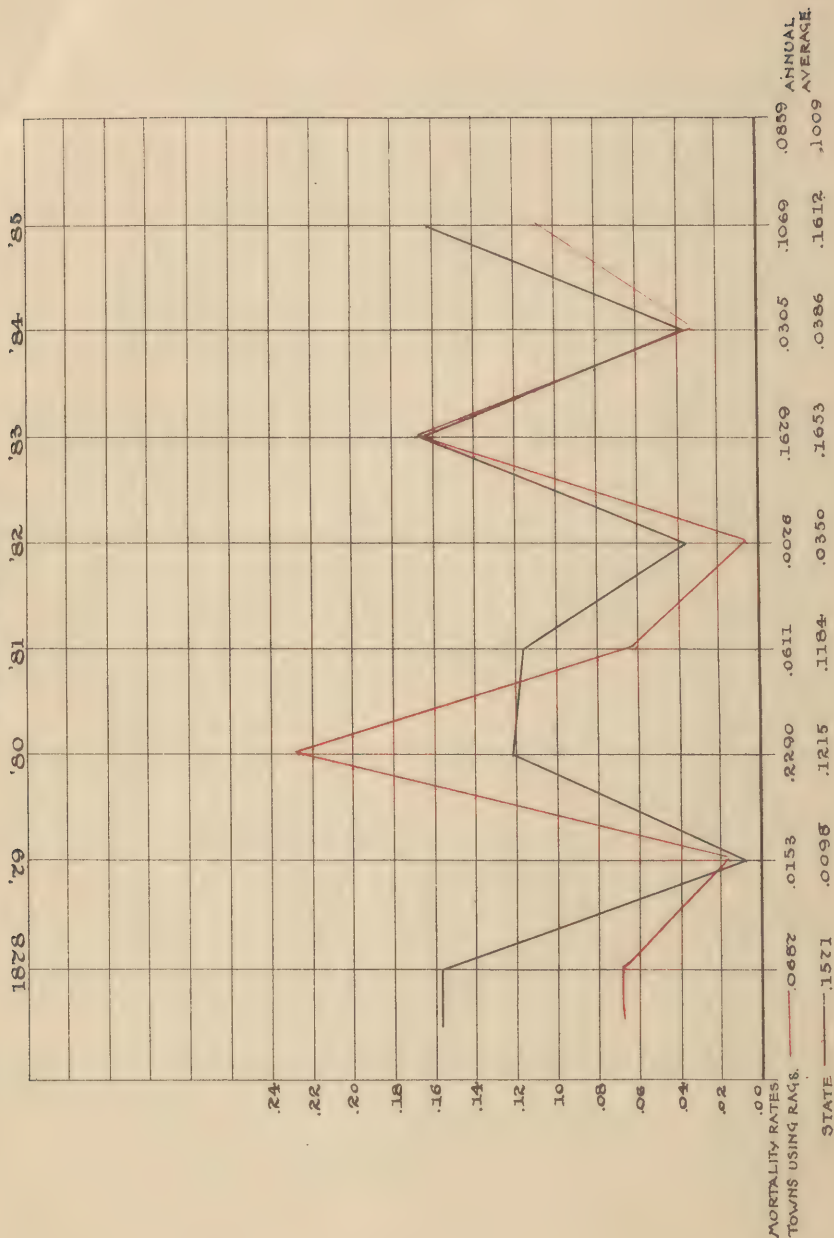
SCARLET FEVER.

MORTALITY RATES
TOWNS USING RAGS
STATE
TOWNS USING RAGS
STATE

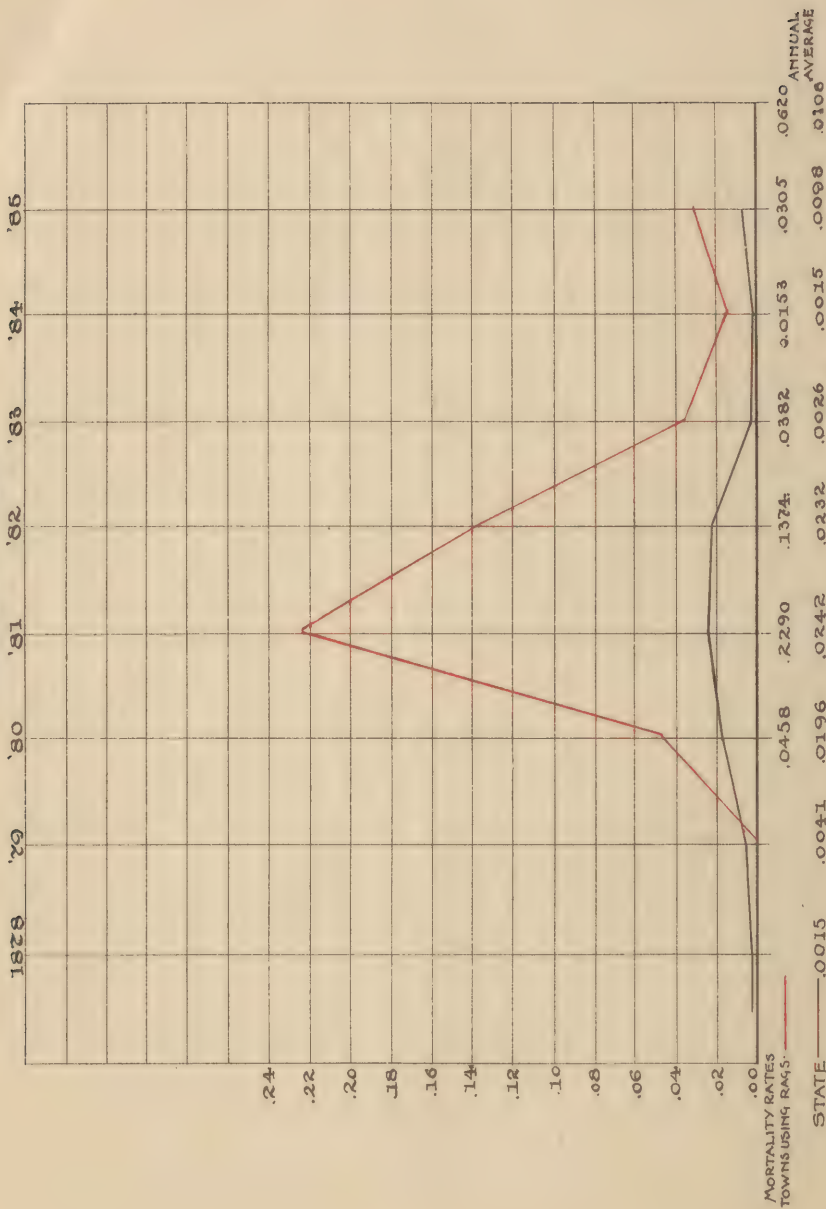


1.042 ANNUAL
353 AVERAGE.
.229

MEASLES.



SMALL POX.



only the last eight years ; hence that period of time was taken for the basis of comparative statistics. There was no record of the absolute number of cases of these infectious diseases occurring during those years, but the number of fatal cases probably afforded a fair standard of comparison as between the different towns.

The charts appended show for each of the last eight years the mortality rates for small-pox, measles, diphtheria (including croup), scarlet fever and typhoid fever per one thousand of population. One of the curves on each chart represents these rates in a group of twenty-two paper-manufacturing towns in which rags were used, comprising Fitchburg, Holyoke, Russell, Westfield, Ware, Groton, Montague, Agawam, West Springfield, Cummington, South Hadley, Huntington, Pepperell, Milton, Newton, Wilbraham, Westminster, Adams, Dalton, Great Barrington, Lee, Hardwick.

Accompanying this curve is another, showing the death-rate per one thousand of population from the same diseases in the same years for the State at large.

The small-pox chart shows, as might be expected, a marked rise in the paper towns above the State at large during the epidemic of 1881-82.

The chart for measles shows a general correspondence of the two curves, except for the year 1880, when there is a sharp rise for the paper towns. This, as well as a similar rise in the charts for scarlet and typhoid fevers, is largely due to the city of Holyoke, which has more of the conditions of an urban population than most of the other towns. With a population of nearly thirty thousand, and with as many manufactories of other products as of paper, there are many French Canadians, who come for a residence of a part of the year, and whose mode of living is such as to invite infectious disease of all sorts. Thus Holyoke, with a population of 21 per cent. of that of the whole group of paper towns, had, in 1880-81, 50 per cent. of the total deaths from measles ; in 1879-80 it had 50 per cent. of the deaths from scarlet fever, and in 1881-82, 38 per cent. of the deaths from typhoid fever.

As in the above series of charts, such a marked divergence from the general average in some of the infectious fevers

was shown by the city of Holyoke; and as that divergence seemed not to be wholly ascribable to the paper industry of the place, it was deemed wise to prepare a second set of charts in which the mortality for the same series of diseases was traced on the one hand in a group of towns comparatively isolated and having no other important industries except the paper manufacture, and on the other hand in a group of manufacturing towns of size, situation and character of population generally corresponding to the former group and differing only in the nature of the product manufactured.

The following towns, in which the manufacture of paper requiring the use of rags was the principal industry, were selected for comparison with the population of towns of a similar size and under similar conditions, but having other industries requiring in-door manufacture. The latter group, it may be added, was selected entirely at random, the only aim being to make the two groups nearly equal in number of towns and in population.

Towns where rags were used in paper manufacture : —

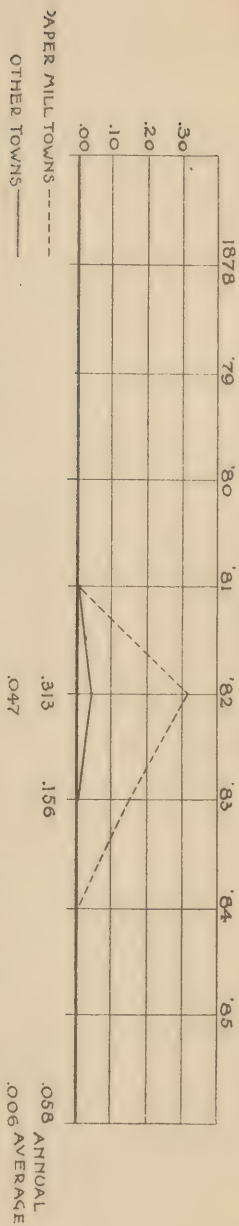
	Population 1885.		Population 1885.
Russell,	847	Wilbraham,	1,724
Agawam,	2,357	Great Barrington,	4,471
Cummington,	805	Lee,	4,274
Pepperell,	2,587		
Dalton,	2,113		19,178

Towns having no paper mills, but having other industries : —

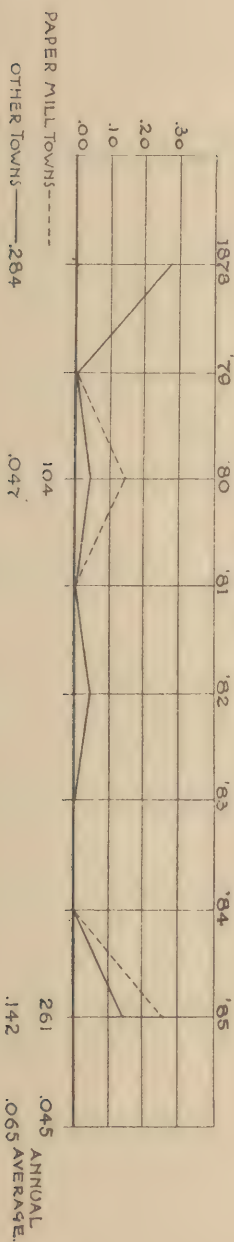
	Population 1885.	
Becket,	938	Leather.
Clarksburg,	708	Woollen manufacturing.
Hinsdale,	1,656	Woollen.
Williamstown,	3,729	Woollen.
Amesbury,	4,403	Woollen.
Essex,	1,722	Boots and shoes.
Northbridge,	3,786	Cotton.
North Brookfield,	4,201	Boots and shoes.
	21,143	

In this second set of charts the number of towns involved — eight in each group — is so small that extraneous and accidental circumstances influence the curves unduly. But there is at least no evidence that the paper-group suffered more

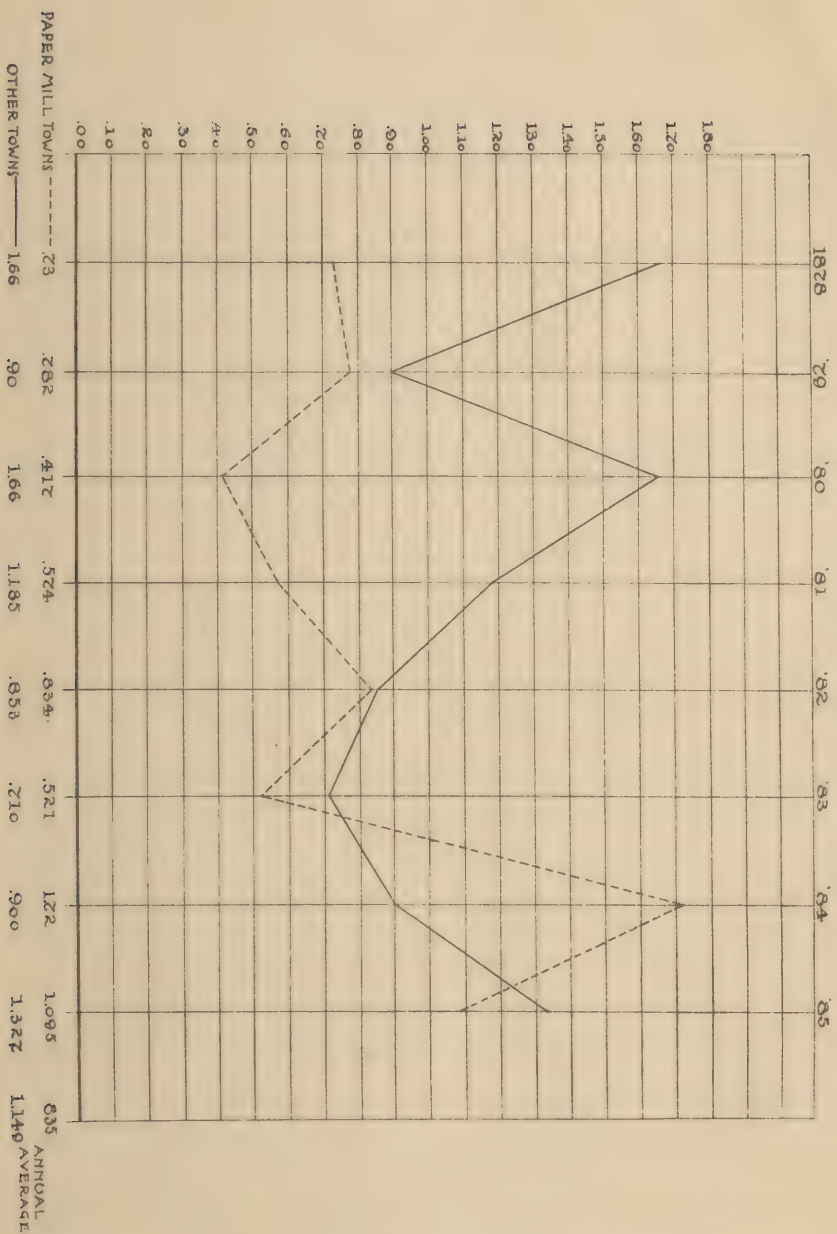
SMALL POX.



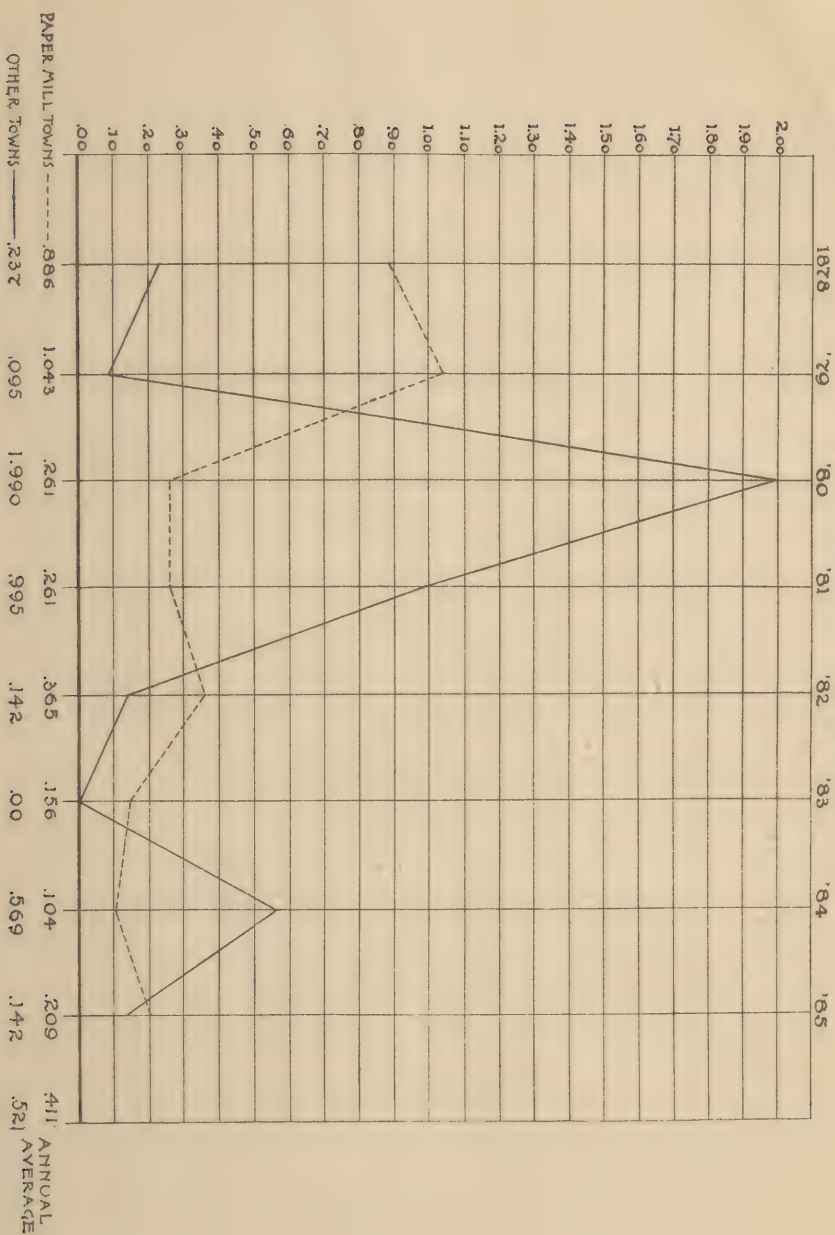
MEASLES.



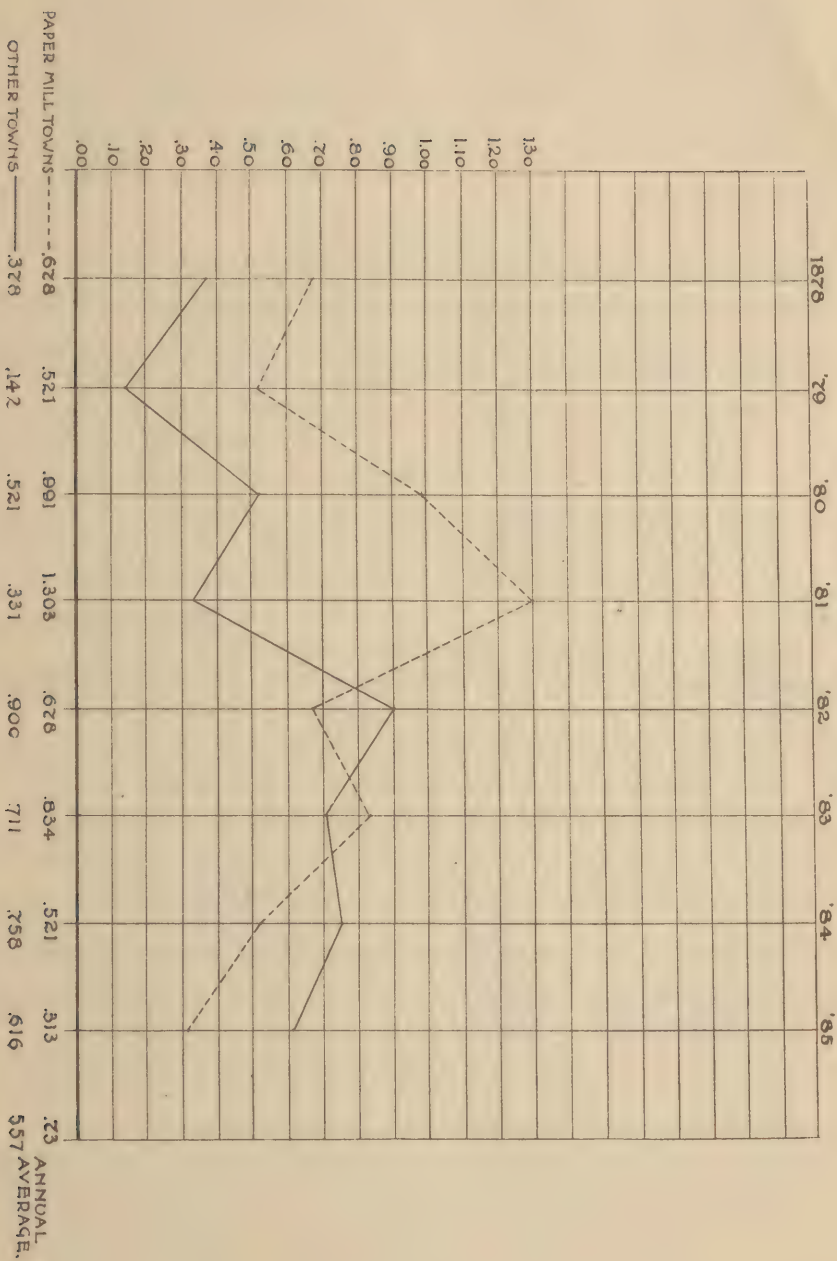
DIPHTHERIA & CROUP.



SCARLET FEVER.



TYPHOID FEVER.



severely than the non-paper group from scarlet fever, measles or diphtheria. In small-pox there is the same preponderance in the paper towns that was shown by the first series of charts. In typhoid fever, also, the eight paper towns appeared to suffer more severely than their fellows.

VI. CONCLUSIONS.

1. Small-pox has been transmitted through the medium of rags in a certain number of cases, small in proportion to the whole number of persons who handle rags, but absolutely numerous enough to show that unvaccinated workers in rags are exposed to an actual, if not imminent, danger of infection from this source.

2. The source of this infection is more frequently domestic than foreign rags, though the disease has been caused by the latter. This possibility of infection through imported rags accords with what is known of the tenacity of life of the variolous poison.

3. Among the rarer means whereby cholera is transmitted are textile fabrics infected with choleraic discharges. There is evidence that clothing from cholera patients, and possibly clothing merely packed in an infected locality, has, when transported to a distance and there unpacked, caused the disease in those who have handled it, thus starting a fresh cholera focus. A proper distinction exists between clothing, on the one hand, recently removed from the body and again not long after to be put on to the body; and rags, on the other hand, which, if transported to this country, are certain to have undergone a carefully discriminative sorting and drying, and to have spent a considerable time in warehouse and on shipboard.

4. The statement that cholera has been transmitted by paper rags rests upon a solitary case, of which the details are not complete, and on the reliability of which some of the highest authorities on cholera have cast doubt. If the case be accepted, it is one of infection by *domestic* rags, carried only fifty miles from their place of collection.

5. An epidemic affection known as "rag-sorters' disease" appears to have broken out on three or four occasions in Euro-

pean paper mills. It was probably, though not certainly, the disease called *Anthrax*.

6. Authenticated instances are not to be found in which the other infectious diseases — typhus and typhoid fevers, scarlet fever, measles and diphtheria — have been transmitted through rags; though it is to be said that such evidence, supposing the fact to exist, would be very difficult to get. Neither do the mortality tables, as shown by registration reports, show a preponderance of deaths from these diseases in the paper-making towns.

7. There is no evidence to show that rag sorters as a class are, except for occasional cases of small-pox and a certain amount of pulmonary irritation from the dust of improperly ventilated rooms, less healthy than other persons engaged in in-door manual occupations.

8. Despite the fact that cholera is not known to have ever been conveyed to this or any other country in foreign baled rags, it is a reasonable precaution to prohibit the landing in any United States port of rags gathered in epidemically infected localities, in view of the possibility that among such rags there may have been thrown articles of infected clothing which have not been sufficiently dried and aired, or have not occupied enough time in their transportation to be devoid of danger. Such prohibitions should be limited to the time and place of epidemic infection; but all necessary precautions should be taken to make sure that rags shipped from a healthy port were not gathered or baled in an infected place.

9. As the only safeguard against the occurrence of small-pox among operatives, paper-mill owners, whether "incorporated companies" within the purview of the statute (chap. 80, sect. 54) or not, should make evidence of successful vaccination an absolute prerequisite to the employment of any person in the mill, and a re-vaccination at regular intervals (not merely on the occurrence of an epidemic in the neighborhood) a condition of being retained in their employ.

10. As the contagion of small-pox, phthisis, and perhaps other diseases, is capable of being inspired when the particles carrying it are suspended in the air in the form of dust, and as dust, even when it carries no contagion, is irri-

tating to the respiratory passages, every mill should have, in connection with each table in the rag-room and in the dusting-room, a ventilating system, preferably consisting of flues connected with an exhaust fan, so that the dust, as fast as it is disengaged, may be withdrawn from the air. The success which attends the working of such an apparatus in some mills where it is in use is a sufficient warrant for its general introduction.

11. A law similar to that of Great Britain (section 125 of the Public Health Act of 1875), imposing a penalty on the selling or giving away of infected rags from persons sick with any dangerous disease, seems desirable in this State. Public institutions and private householders should be obliged (and not as at present, simply advised) to insure the disinfection of the more valuable articles and the destruction by fire of **all rags that have been thus exposed.**

12. As domestic rags comprise more than half those used, and represent a still larger proportion of the infection likely to be carried, it follows that they should participate in whatever disinfection is thought necessary. This fact points to the paper mill as the proper place for making such disinfection. The sulphur process would doubtless afford the least embarrassment to the manufacturer; the bales being opened in a tightly closed room, the rags being spread on racks, and sulphur burned in the proportion of two pounds to each one thousand cubic feet of space. The introduction of steam under pressure, the rags being similarly disposed, would be the most effective disinfection possible, but would dampen the rags to their injury, unless the moisture were dried out at once with a current of hot air.

